(Pg 94) - SYSTEM ... RES...
EMG STOP SWITCH (BACK)

OPERATOR'S MANUAL

LJ-SERIES

CNC LATHES & CNC TURNING CENTERS

with FANUC SYSTEM 10T-A

WASINO ENGINEERING CO., LTD.

WASINO SERIAL No. 314

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1. PREPARATIONS BEFORE INSTALLATION

The followings are necessary before installation of the machine.

1-1 Power supply

AC power line of 200V ± 10%, 50/60 ± 1Hz, 3-phase, or 220V ± 10%, 60 ± 1Hz, 3-phase. (For the different voltage area, the power transformer is required and will be supplied by WASINO.)

The required power capacity and cables are:

Model	Main motor	Power capacity	Cable section
LJ-62 LJ-62M LJ-102 LJ-102M LJ-63M LJ-103M	AC 15/18.5 kW (20/25 Hp)	33 kVA approx. (Refer to the table 1-1.)	Over 38 mm^2 (0.06 in^2)

1-2 Compressed air

5 ~ 7 kg/cm^2 (70 ~ 100 psi) if the machine is provided with air blow device or other pneumatic equipments.

1-3 Coolant

110 liters (29 gal.)

1-4 Lubricant

All rubricants specified in the paragraph 8-6. Page 64

1-5 Installation site

The required floor space for installation of the machine is:

Model	Floor space
LJ-62 LJ-62M LJ-63M	3300 mm x 2000 mm (130 in. x 79 in.)
LJ-102 LJ-102M LJ-103M	4100 mm x 2000 mm (161 in. x 79 in.)

Notes) 1. The floor space changes for machine with loader, robot, barfeeder, and other peripheral equipments.

2. The above floor space is the machine floor space and does not include the maintenance space. (Refer to the paragraphes 2-2 and 2-3.)

1-6 Environmental conditions

The machine should be used in an ambient temperature of from 0° to 45°C and a humidity under 75%.
A rapid temperature change or sharp impact should be avoided as these may not only cause loosening of clamped parts and erroneous operation of relays, but also damage the machine. Avoid dusty or dirty places.
Install the machine so that it is not exposed to direct sunlight.

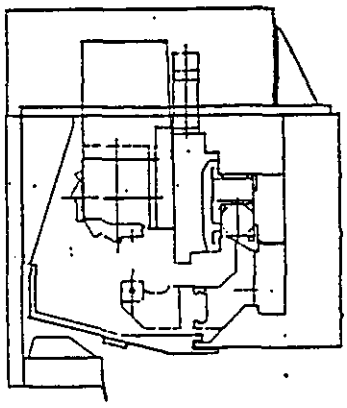
Table 1-1 Power supply data sheet

LJ-62, 102, 62M, 102M, 63M, 103M			
	Part name	Output power (kW)	Power supply (kW)
Standard	Spindle motor	18.5	23.0
	X-axis servo motor	0.9	1.5
	Z-axis servo motor	1.8	3.0
	CNC unit	(0.3)	0.4
	Hydraulic pump unit	1.5	2.0
	Coolant pump motor	0.25	0.5
	Control circuit	(1.0)	1.3
	Lubrication pump motor	0.075	0.2
	Total (Standard)	24.3	31.9
Option	Portable tape reader	(0.08)	0.1
	Coolant pump motor	0.4	0.8
	Chip conveyer	0.1	0.2

Note) Value in ( ) is that of conversion.

2. MACHINE CONFIGURATION

2-1 Names of main parts



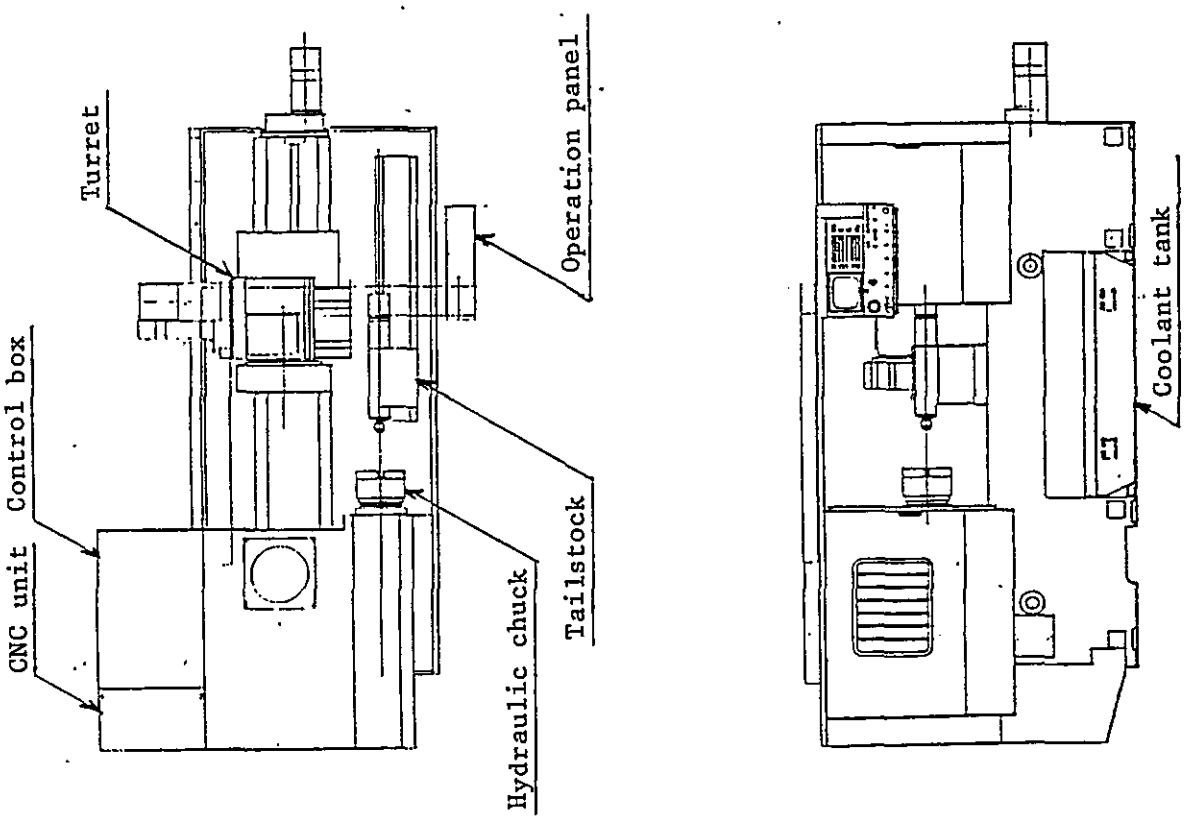


Fig. 2-1

Note) Model LJ-103M is shown.

2-2 Main dimensions (LJ-62, LJ-62M and LJ-63M)

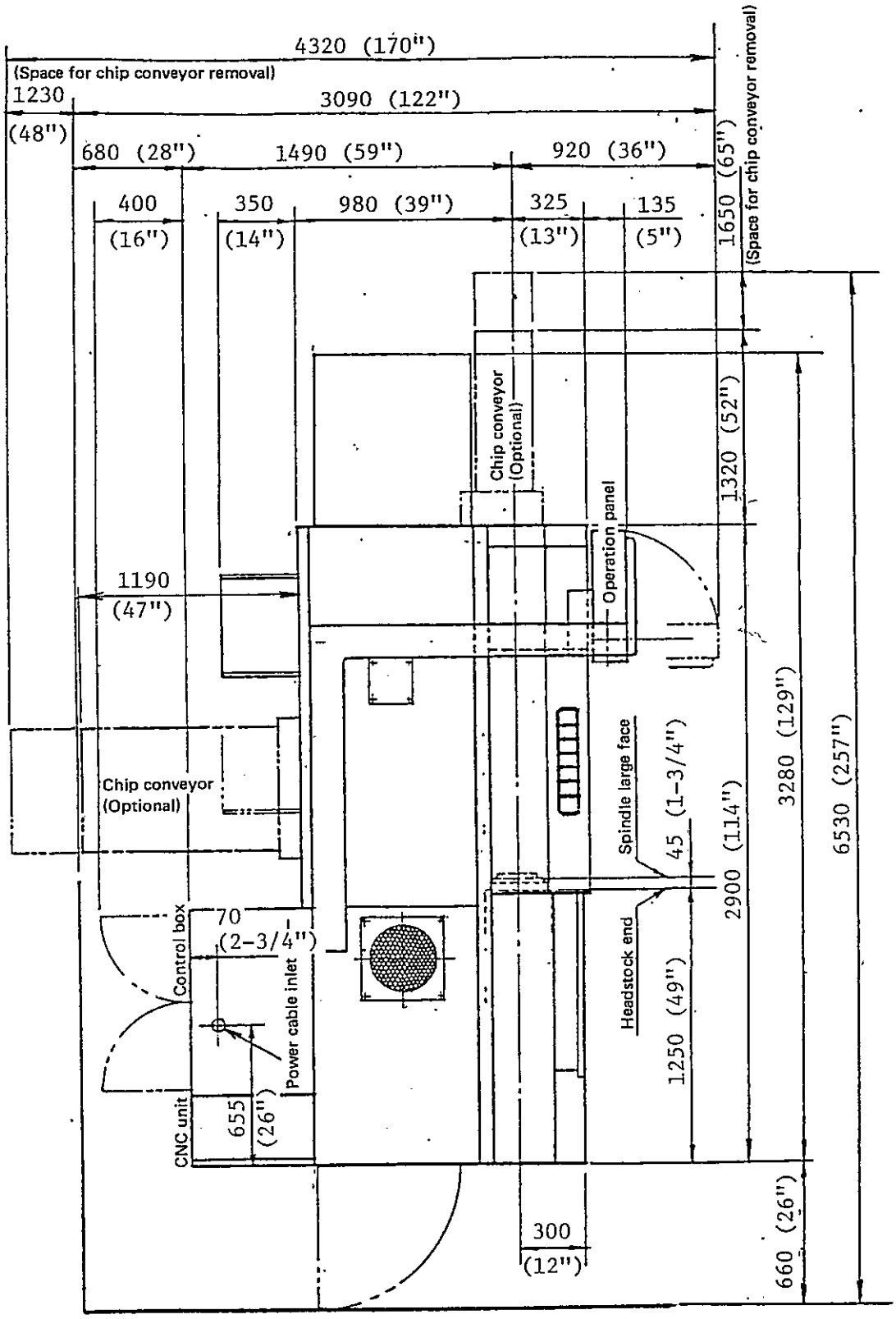


Fig. 2-2

2-3 Main dimensions (LJ-102, LJ-102M and LJ-103M)

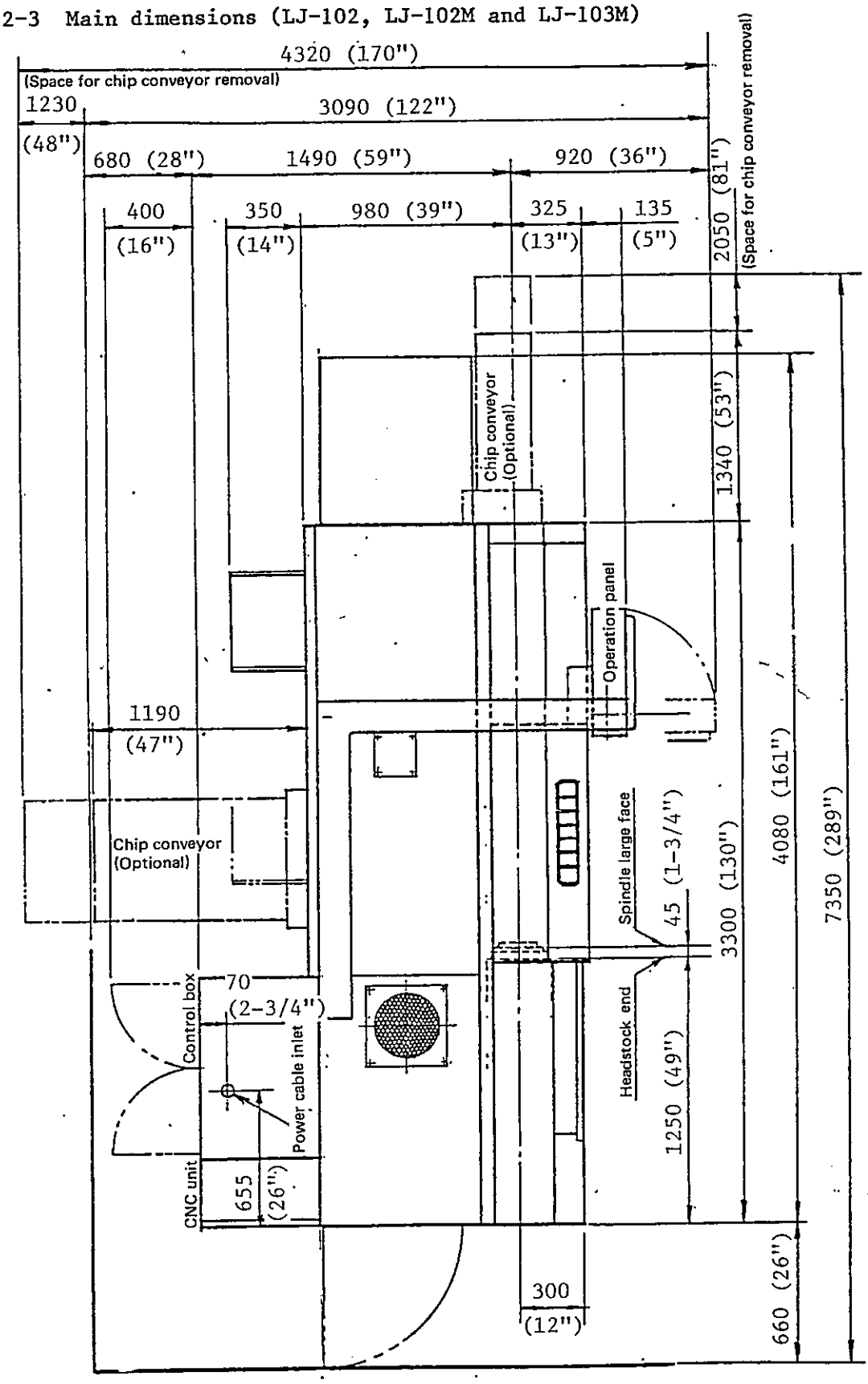


Fig. 2-3

3. SPECIFICATIONS

3-1 Machine specifications

Designation		Unit	LJ-62	LJ-102	LJ-62M	LJ-102M	LJ-63M	LJ-103M
Capacity								
Swing over bed		mm(in.)	ϕ430 (17)					
Nominal workpiece dia.		mm(in.)	ϕ220 (9)					
Between centers		mm(in.)	600 (24)	1000 (40)	600 (24)	1000 (40)	600 (24)	1000 (40)
Bar capacity		mm(in.)	ϕ44.5 (1-3/4)/ϕ64 (2-1/2) *1					
Headstock								
Center height from floor		mm(in.)	1100 (43)					
Spindle nose			A2 No.8					
Spindle bore		mm(in.)	ϕ77 (3)					
No. of spindle speed			Auto. 2-step x inf. variable					
Spindle speed	Low	rpm	10 ~ 1060					
	High	rpm	35 ~ 3500					
Chuck	Standard		No.8/No.10 *2					
	Chuck bore	mm(in.)	ϕ45 (1-3/4)/ϕ65 (2-1/2) *3					
Spindle indexing								
Indexing method			——		External orientation		C axis	
Minimum increment		deg.	——		2.5		0.001	
Travel								
X-axis		mm(in.)	245 (9-1/2)					
Z-axis		mm(in.)	620 (24-3/8)	1020 (40-1/8)	620 (24-3/8)	1020 (40-1/8)	620 (24-3/8)	1020 (40-1/8)

Designation	Unit	LJ-62	LJ-102	LJ-62M	LJ-102M	LJ-63M	LJ-103M
Rapid traverse							
X-axis	mm/min. (ipm.)	8000 (315)					
Z-axis	mm/min. (ipm.)	10000 (394)					
C-axis	rpm	———				22.2	
Turret							
Turret type		12 station drum (V12)					
No. of tools		12 (Turning)		6 (Turning) + 6 (Milling) *4			
Turning tool							
Standard tool	mm(in.)	□25 (□1)					
Max. boring bar	mm(in.)	ϕ50/ϕ50.8 (2) *5					
Milling unit							
Motor	kW(Hp)	———		AC 2.2/3.7 (3/5)			
Spindle speed	rpm	———		35 ~ 3000			
Shank dia.	mm(in.)	———		ϕ20 (3/4)			
Milling unit capacity							
Drilling	mm(in.)	———		ϕ22 (7/8)			
End milling	mm(in.)	———		ϕ20 (3/4)			
Tapping		———		M12			
Others	mm(in.)	———		ϕ50 (2) Face mill			
Tailstock							
Quill dia.	mm(in.)	ϕ80 (3-1/8)					
Tailstock center		MT No.5					
Quill travel	mm(in.)	100 (4)					
Cylinder thrust	kg (lbs)	157 (345) under hyd. pressure of 10 kg/cm^2					

Designation	Unit	LJ-62	LJ-102	LJ-62M	LJ-102M	LJ-63M	LJ-103M
Bed width	mm(in.)	400 (15-3/4)					
Main motor	kW(Hp)	AC 15/18.5 (20/25)					
CNC unit		FANUC SYSTEM 10T-A					
Power capacity	kVA	33					
Power source		AC 200V ± 10% 50/60Hz ± 1Hz or AC 220V ± 10% 60Hz ± 1Hz (3-phase)					
Floor space	mm(in.)	LJ-62, 62M, 63M: 3300 x 2000 (130 x 79) LJ-102, 102M, 103M: 4100 x 2000 (161 x 79)					
Net weight (Approx.)	kg (lbs)	4700 (10300)	5150 (11300)	4800 (10600)	5250 (11600)	4850 (10700)	5300 (11700)

Notes) *1 Bar capacity of ϕ44.5 mm (1-3/4") is with No.8 chuck while ϕ64 mm (2-1/2") with No.10 chuck.

*2 No.8 chuck is standard for all countries except U.S.A. while No.10 chuck for U.S.A.

*3 Chuck bore of ϕ45 mm (1-3/4") is with No.8 chuck while ϕ65 mm (2-1/2") with No.10 chuck.

*4 12 turning tools can be attached as well.

*5 Max. boring bar of ϕ50 mm is for all countries except U.S.A. while ϕ2" (50.8 mm) for U.S.A. as standard.

3-2 Standard accessories

Designation		LJ-62, 102		LJ-62M, 63M, 102M, 103M		Remark
		For U.S.A.	For other countries	For U.S.A.	For other countries	
Thru-hole hydraulic chuck No.8		-	1	-	1	
Thru-hole hydraulic chuck No.10		1	-	1	-	
Coolant equipment (with 250W pump)		1	1	1	1	Tank capacity 110 liters (29 gal.)
Splash guard		1	1	1	1	
Work light		1	1	1	1	
Tool kit and spare parts		1	1	1	1	
Barfeeder interface		1	1	1	1	
Spindle load meter		1	1	1	1	
Milling spindle load meter		-	-	1	1	
Spindle speedometer		1	1	1	1	
Milling spindle speedometer		-	-	1	1	
Hydraulic tailstock with auto-sleeve		1	1	1	1	
Live center		1	1	1	1	
Input/output interface connector		1	1	1	1	Installed on operation panel
Power transformer		-	1	-	1	
Tooling (Turning)						
Tool holder	For OD (□25)	-	4	-	4	JOH1A
	For face (□25)	-	2	-	2	JFH1A
Boring holder	(ø50)	-	6	-	6	JBH1I

Designation		LJ-62, 102		LJ-62M, 63M, 102M, 103M		Remark
		For U.S.A.	For other countries	For U.S.A.	For other countries	
Round bushing	(ϕ50 x ϕ10)	-	1	-	1	JRB13
	(ϕ50 x ϕ12)	-	1	-	1	JRB14
	(ϕ50 x ϕ16)	-	1	-	1	JRB15
	(ϕ50 x ϕ20)	-	1	-	1	JRB16
	(ϕ50 x ϕ25)	-	1	-	1	JRB1A
	(ϕ50 x ϕ32)	-	1	-	1	JRB1C
	(ϕ50 x ϕ38)	-	1	-	1	JRB1E
	(ϕ50 x ϕ40)	-	1	-	1	JRB1F
	(ϕ50 x ϕ45)	-	1	-	1	JRB1G
Drill socket	(M.T. No.1)	-	1	-	1	JDA11
	(M.T. No.2)	-	1	-	1	JDA12
	(M.T. No.3)	-	1	-	1	JDA13
	(M.T. No.4)	-	1	-	1	JDA14
Coolant pipe		6	6	6	6	JPB01
Tool holder	For OD (□1")	4	-	4	-	JOH2A
	For face (□1")	2	-	2	-	JFH2A
Boring holder	(ϕ2")	6	-	6	-	JBH21
Round bushing	(ϕ2" x ϕ3/8")	1	-	1	-	JRB23
	(ϕ2" x ϕ1/2")	1	-	1	-	JRB24
	(ϕ2" x ϕ5/8")	1	-	1	-	JRB25
	(ϕ2" x ϕ3/4")	1	-	1	-	JRB26
	(ϕ2" x ϕ1")	1	-	1	-	JRB2A
	(ϕ2" x ϕ1-1/4")	1	-	1	-	JRB2C
	(ϕ2" x ϕ1-1/2")	1	-	1	-	JRB2E
	(ϕ2" x ϕ1-3/4")	1	-	1	-	JRB2G

Designation		LJ-62, 102		LJ-62M, 63M, 102M, 103M		Remark
		For U.S.A.	For other countries	For U.S.A.	For other countries	
Drill socket	(M.T. No.1)	-	-	-	-	JDA21
	(M.T. No.2)	-	-	-	-	JDA22
	(M.T. No.3)	-	-	-	-	JDA23
	(M.T. No.4)	-	-	-	-	JDA24
Tooling (Milling)						
Milling unit	MXW20 (radial)	-	-	6(4)	6(4)	Q'ty in ( ) is for LJ-62M and 102M.
	MZW20 (axial)	-	-	3(2)	3(2)	
Master collet (ø19.05-3/4")	MCX3/4 (radial)	-	-	6(4)	-	
	MCZ3/4 (axial)	-	-	3(2)	-	
Straight collet	C20 - 12	-	-	-	1	
Collet with nut	BC-10	-	-	-	1	
	BC-8	-	-	-	1	
	BC-6	-	-	-	1	
Baby chuck	SMB20	-	-	-	1	
Straight collet (for baby collet)	C6-4	-	-	-	1	
Chuck holder	C20-J6	-	-	-	1	
Drill chuck	#2-1/2	-	-	-	1	
Tap holder	S20-FT12	-	-	-	1	
Coolant pipe		-	-	6	6	JPM01

3-3 Optional accessories

Designation			LJ-62, 102		LJ-62M, 63M, 102M, 103M		Remark
			For U.S.A.	For other countries	For U.S.A.	For other countries	
Chip conveyor	Side type						
	Rear type						
Chip cart							
Programmable tailstock							
Barfeeder							
Parts catcher							
Automatic door							
Various chucks and collet adaptors							*1
Power transformer				-		-	*2
Automatic centering steady rest							
Powerful coolant equipment							
Turret coolant equipment							
Spare parts for one year							
Spare parts for three years							
Tooling (for turning)							
Various tool holders							
Various round bushings							
Various drill sockets							
Tooling (for milling)							
Angular milling unit		MAW10	-	-			*3
Offset milling unit (X)		MOX10	-	-			*3
Offset milling unit (Z)		MOZ10	-	-			*3
Vertical milling unit		MVW12	-	-			*3

Designation		LJ-62, 102		LJ-62M, 63M, 102M, 103M		Remark
		For U.S.A.	For other countries	For U.S.A.	For other countries	
Albrecht drill chuck	130-J6	-	-	-		
Drill spindle	DX5-JT6	-	-	-		
Face mill arbor	C20-F2	-	-	-		
Auto tapper (M2 ~ M5)	C05	-	-	-		
Various straight collets (for drills)		-	-	-		*4
M.T. holder	C20-M.T.1	-	-	-		
	C20-M.T.2	-	-	-		
Straight collet	C20-16	-	-	-		
	C20-12	-	-	-		
	C20-10	-	-	-		
	C20-8	-	-	-		
	C20-6	-	-	-		
Collet with nut	BC-10	-	-	-		
	BC-8	-	-	-		
	BC-6	-	-	-		
Baby chuck	SMB-20	-	-	-		
Straight collet (for baby chuck	C6-5	-	-	-		
	C6-4	-	-	-		
	C6-3	-	-	-		

Notes) *1 Please inquire for the details.

*2 For countries other than U.S.A., the power transformer is a standard accessory.

*3 Please inquire for the details.

*4 Please specify the inner diameter of collet when placing an order.

4. INSTALLATION

4-1 Unpacking

The main body is coated with special anti-rust grease and covered with anti-rust paper. It is shipped in a wooden crate for a long distance. Other parts and equipment are also shipped in wooden crates. When uncrating, be careful not to damage the machine or the parts. After uncrating, wipe off the anti-rust grease with clean and dry rags. Then, inspect if any damages were made during the transit. If there are damages or shortages of parts, contact WASINO immediately.
Do not use lacquor thinner or lacquor cleaner to clean the machine.

4-2 Lifting (See Fig. 4-1)

In order to lift the crated machine for unloading, use wire ropes with the diameter of 24 mm (0.95") or over under the wooden bases. To lift the uncrated machine, hook the wire ropes with the lifting brackets as shown in Fig. 4-1. Lift the machine once slightly to check the balance. Protect the machine with wooden blocks and rags where the wire ropes come into contact with the machine.
Lift and lower the machine gently and carefully and, do not lower the machine hard on the floor.

4-3 Installation foundation (See Fig. 4-2 and 4-3.)

The foundation drawing given in this manual concerns the general case. If the ground is soft, increase the thickness of the concrete and the pebbles as necessary.
If the machine is to be fixed with anchor bolts, make holes as shown for the anchor bolts (200 (8") square and depth of 450 (12") from the floor).

If the machine is to be installed without anchor bolts, place the base plates under the jack bolts. Level the machine using precision level in lengthwise and widthwise directions by adjusting the jack bolts. Apply mortar on the machine base except where it interferes with the operation to prevent slip and vibration. Start the machine only after the mortar is hardened completely.

Install the machine carefully and accurately in order to maintain the accuracy of the machine for a long time.

Check the level once again after the installation, check it after 1 month of starting the operation, and then, check it every half year thereafter.

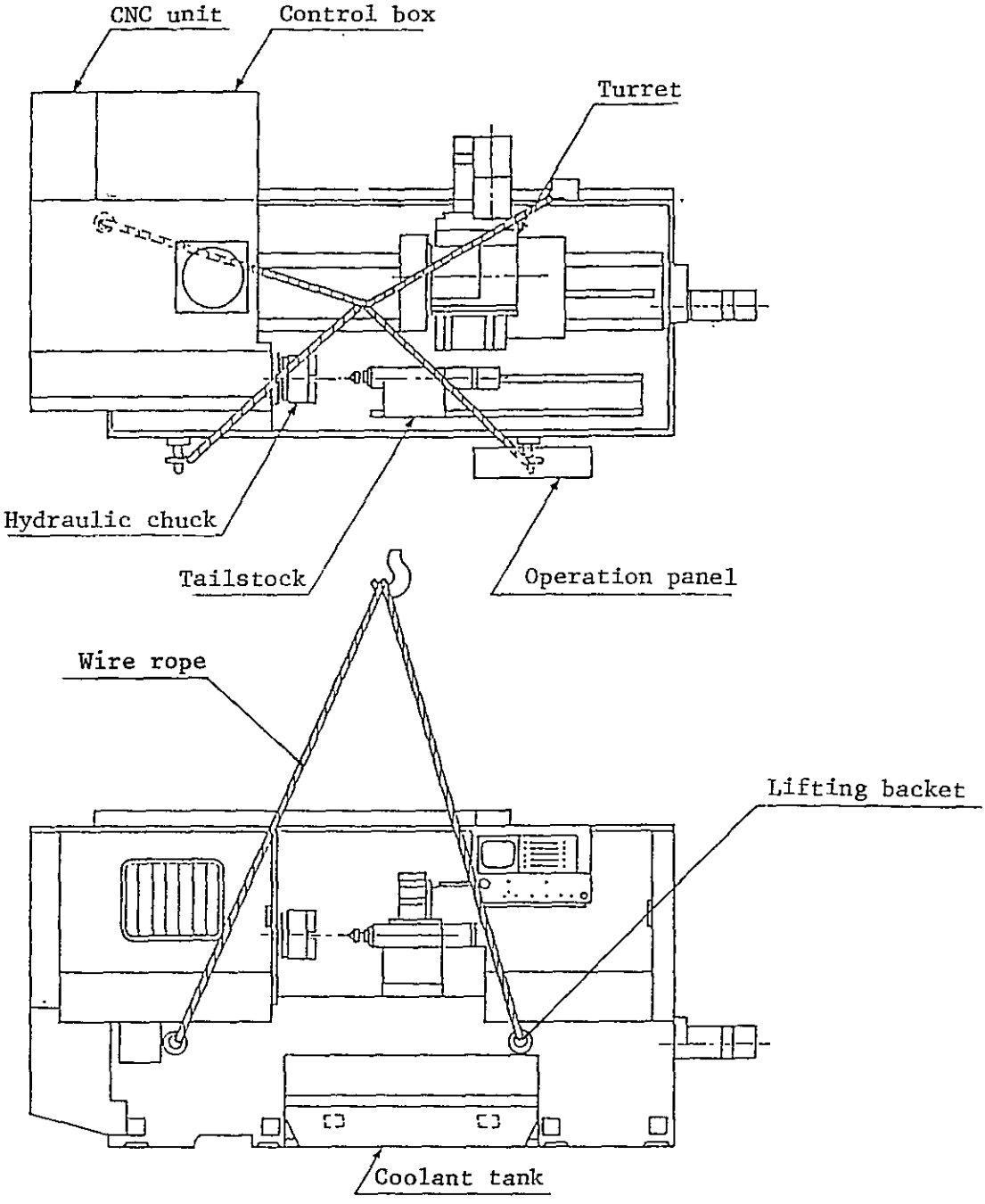
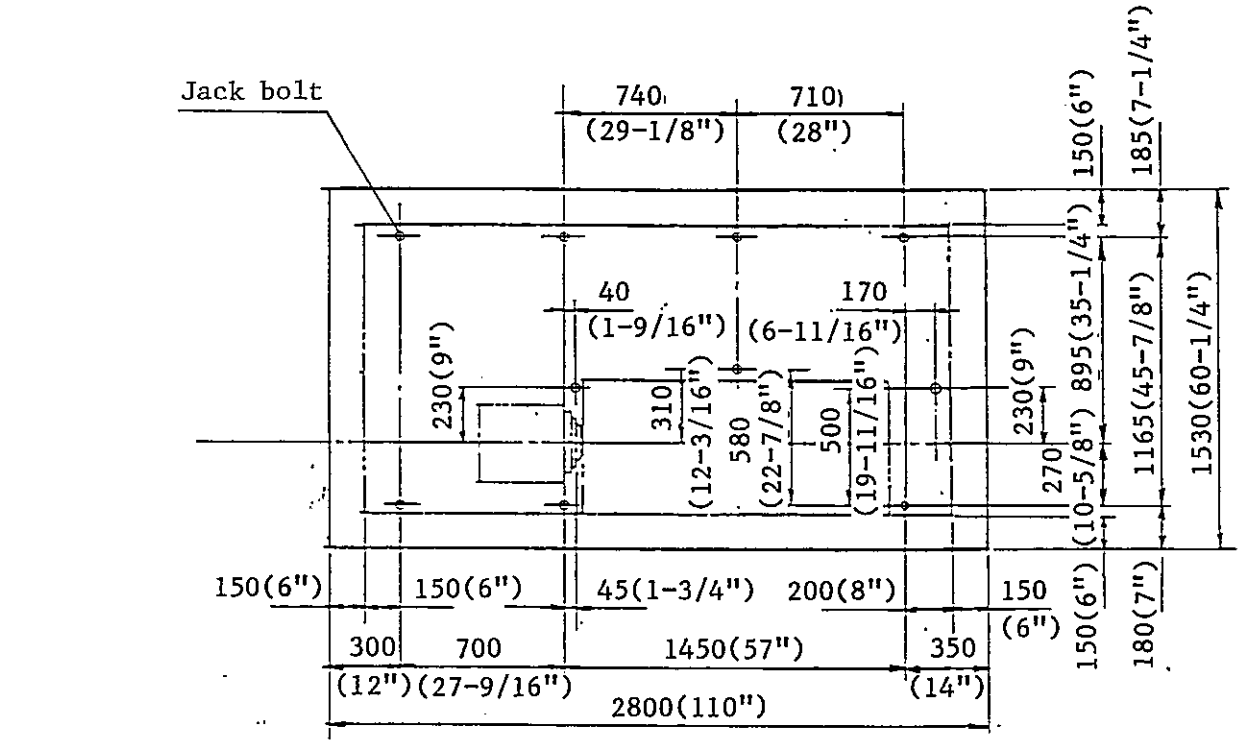


Fig. 4-1 Lifting



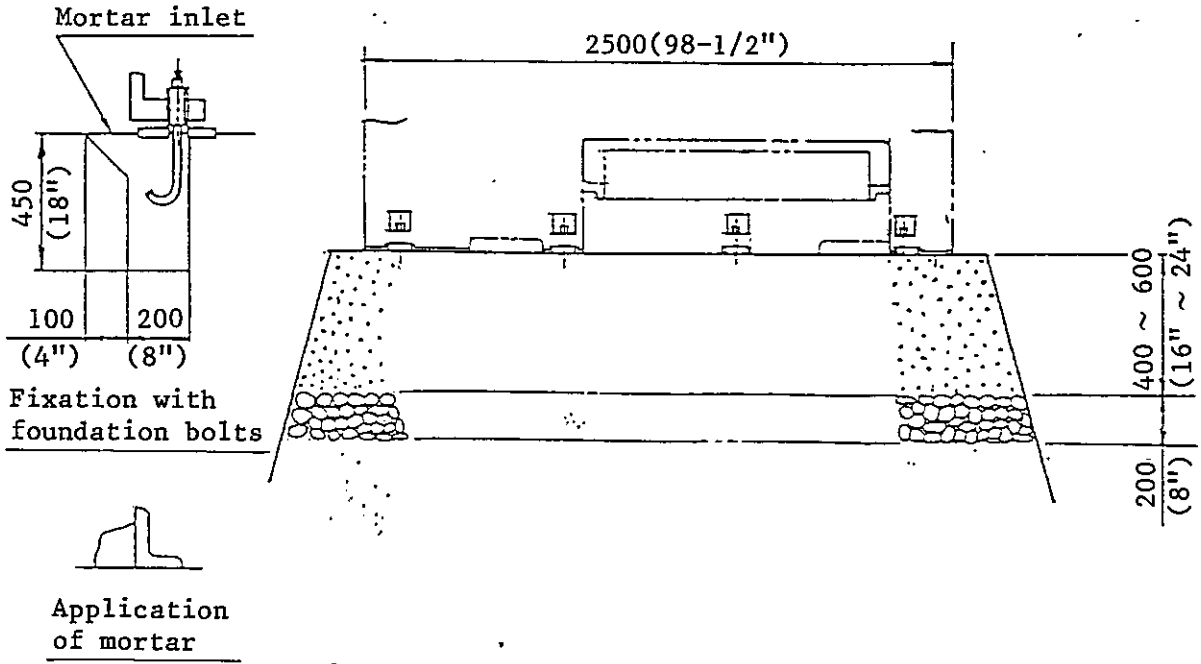


Fig. 4-2 Foundation (LJ-62, 62M, 63M)

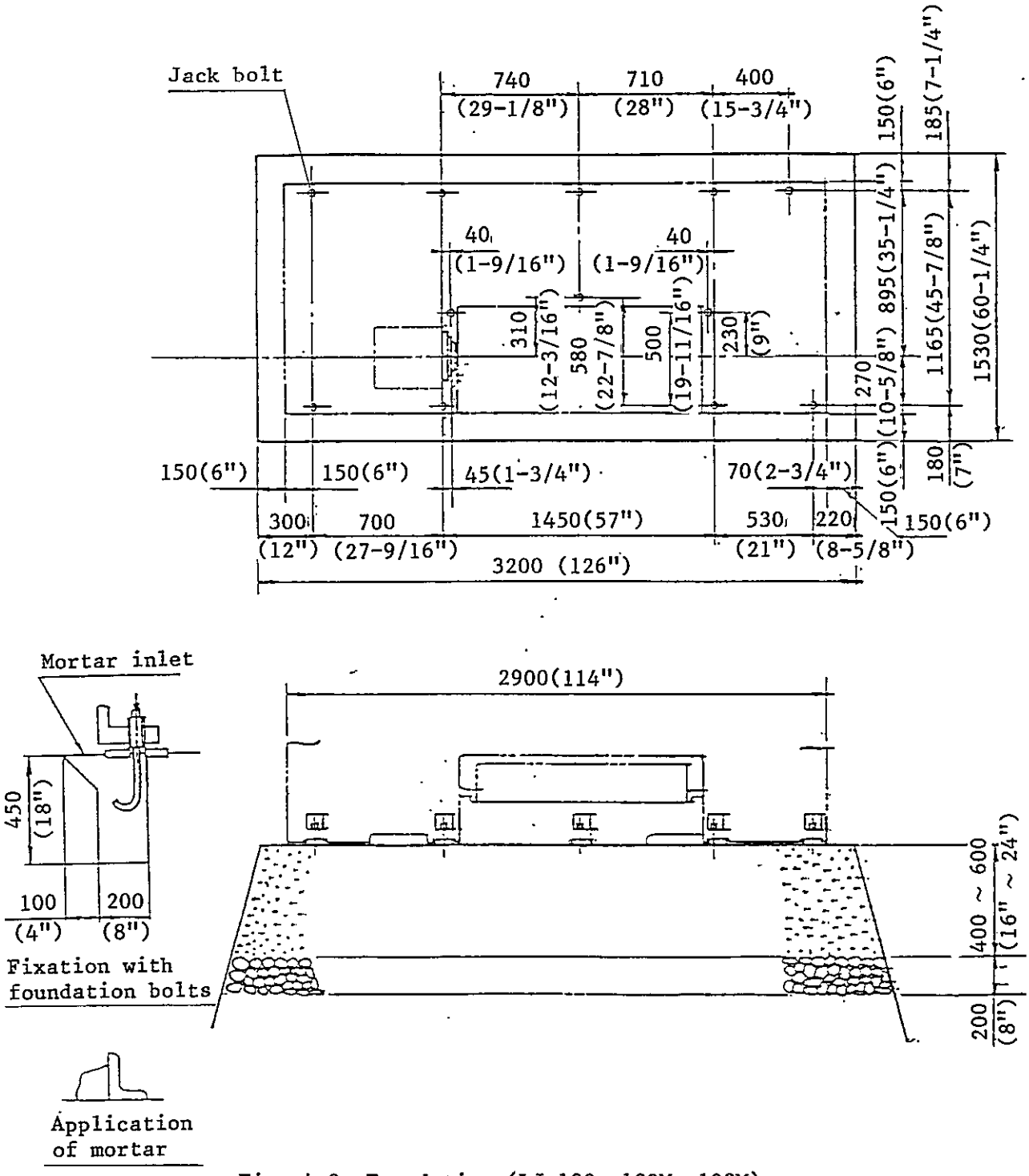


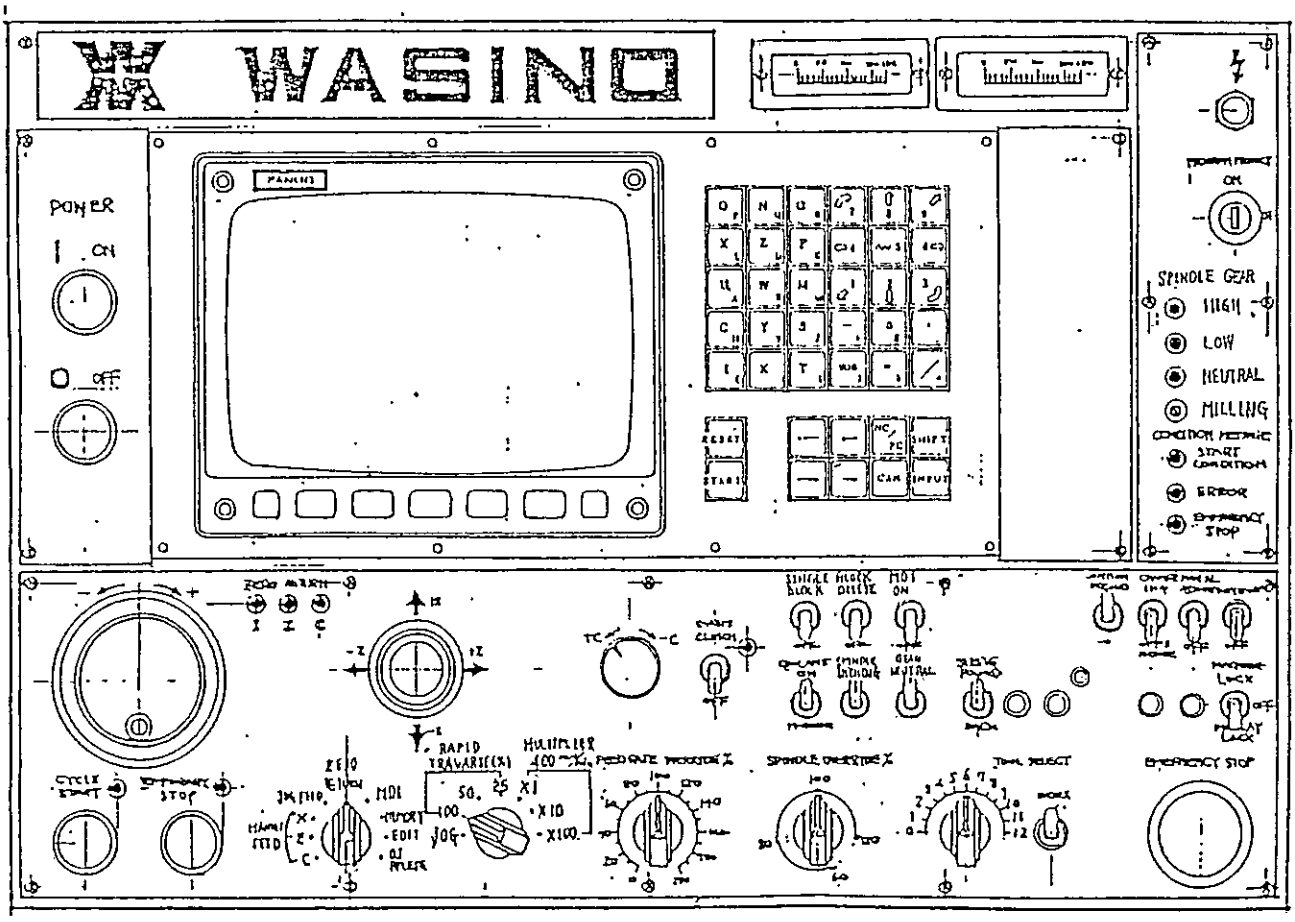
Fig. 4-3 Foundation (LJ-102, 102M, 103M)

5. OPERATION PANEL

All functions are grouped compactly on the panel permitting easy operation. Operators can operate the machine at the easy-to-control position and tape editing.

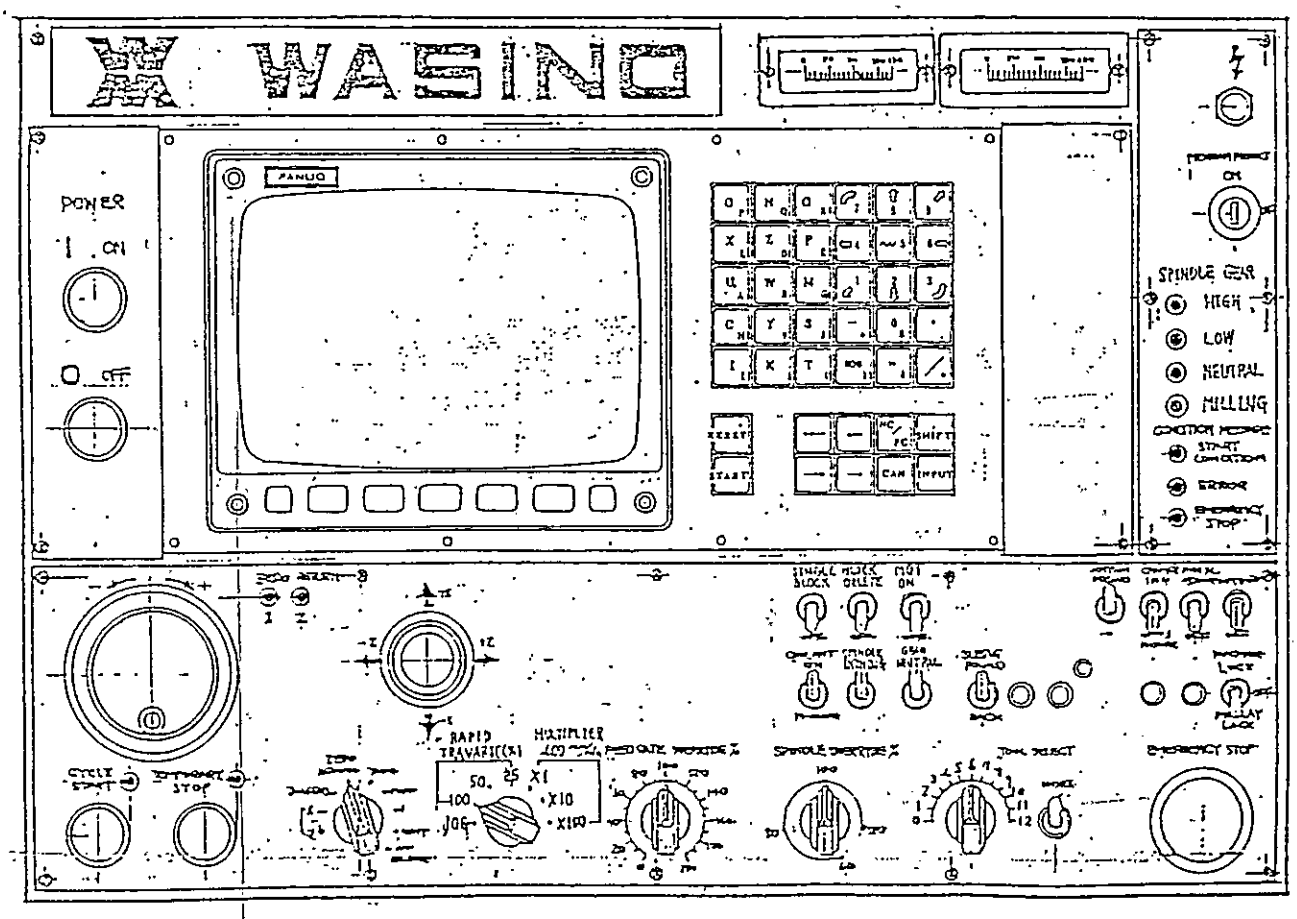
5-1 Appearance of operation panel

5-1-1 FANUC SYSTEM 10T-A (LJ-63M, LJ-103M)



Note) Disposition of switches, pushbuttons, etc., is subject to change.

5-1-2 FANUC SYSTEM 10T-A (LJ-62, LJ-62M, LJ-102, LJ-102M)



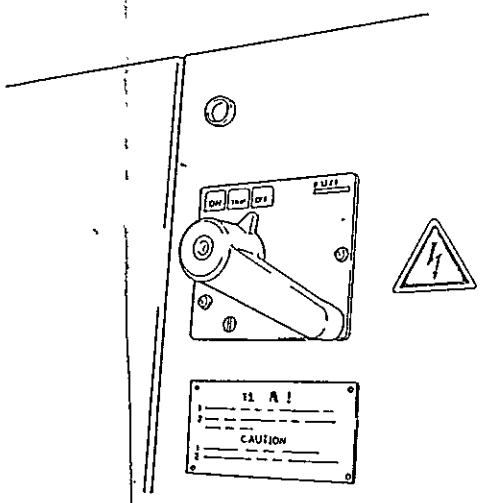
Note) Disposition of switches, pushbuttons, etc., is subject to change.

5-2 Components of operation panel

No.	Name
1	POWER ON button
2	POWER OFF button
3	CYCLE START button
4	TEMPORARY STOP button
5	CYCLE START indicator lamp
6	TEMPORARY STOP indicator lamp
7	EMERGENCY STOP button
8	MODE SELECT switch
9	FEED MODE select switch
10	FEED RATE OVERRIDE dial
11	Manual pulse generator
12	Manual feed lever
13	X, Z axis zero return indicator lamps
14	SPINDLE OVERRIDE dial
15	TOOL SELECT switch
16	TOOL INDEX switch
17	GEAR NEUTRAL switch
18	SPINDLE INCHING switch
19	COOLANT switch
20	SLEEVE (quill) switch
21	POWER ON indicator lamp
22	PROGRAM PROTECT key switch
23	Spindle gear position indicator lamp
24	Milling operation indicator lamp
25	CONDITION MESSAGE lamps
26	MDI & CRT
27	SINGLE BLOCK switch
28	BLOCK DELETE switch
29	M01 (OPTIONAL STOP) switch
30	POSITION RECORD switch
31	CHAMFERING switch
32	MANUAL ABSOLUTE switch
33	DRY RUN switch
34	MACHINE LOCK switch
35	C AXIS CLUTCH switch
36	C axis clutch ON indicator lamp
37	C axis manual feed button
38	C axis zero return indicator lamp

5-3 Operation

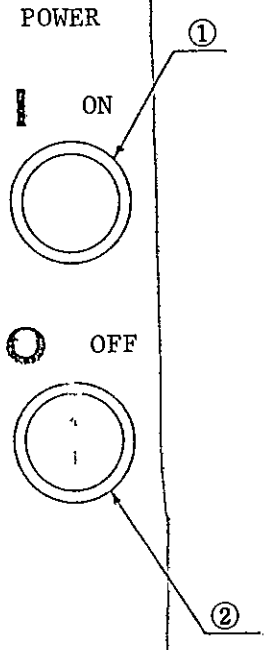
5-3-1 Main power breaker



First, turn on this no-fuse breaker to supply the main power to the machine.
The power on indicator (21) and the worklight come on at the same time.

5-3-2 POWER ON button (1)

5-3-3 POWER OFF button (2)



* Depress the power on button (1) for the CNC unit. Then, the machine is ready to start electrically.
* In order to turn off the power after running the machine, depress the power off button (2) of the CNC unit first and then turn off the no-fuse breaker on the main machine.
  If this operation is carried out in the reverse way, the CNC unit may be damaged in some cases.

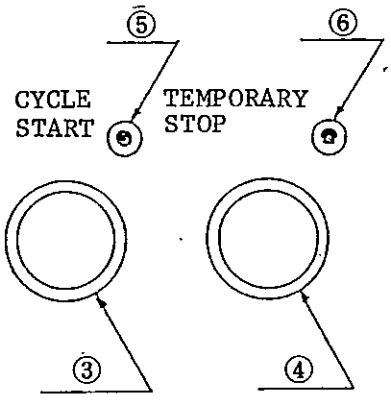
Note)
Unless the reference point return is carried out by the manual feed lever (12), the CNC unit does not function correctly. Therefore, carry out the reference point return as soon as the power is supplied to the CNC unit, and then, carry out other operations.

5-3-4 CYCLE START button (3)

5-3-5 TEMPORARY STOP button (4)

5-3-6 Cycle start indicator lamp (5)

5-3-7 Temporary stop indicator lamp (6)

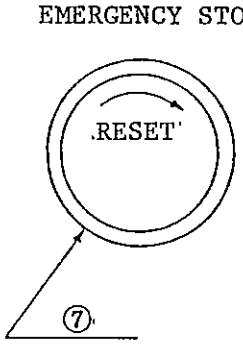


* The cycle start button (3) is to be depressed to start the automatic operation.
(The lamp (5) is lit during the automatic operation.)

* When the temporary stop button (4) is depressed during the automatic operation, the machine stops temporarily and the lamp (6) comes on.

* To restart the machine from that status, depress the cycle start button (3) again.

5-3-8 EMERGENCY STOP button (7)

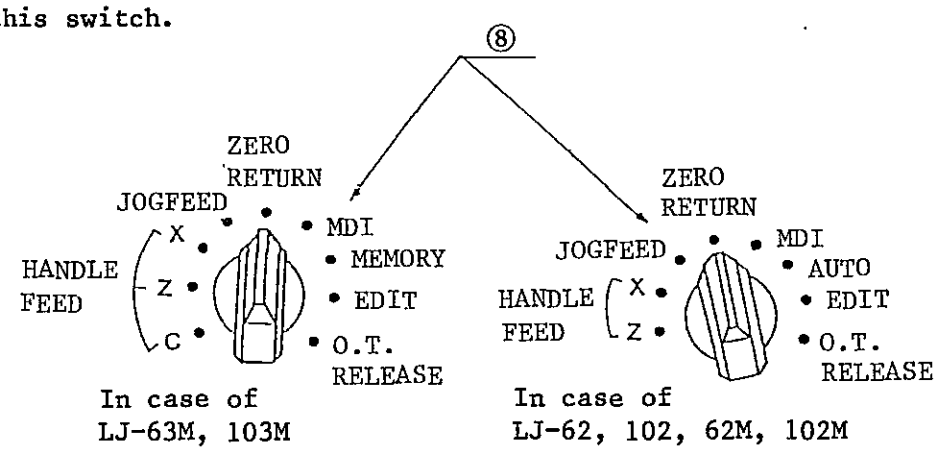


* When this button is depressed, the machine and the CNC unit are stopped at once under any condition. It is effective for an emergency stop during the automatic operation. When this button is depressed, the "READY" display on the CRT screen disappears. The status of emergency stop is released by turning the button in the direction of "RESET" (clockwise).

* This button is a self-lock type and release the lock after finding out and removing completely the cause of the emergency stop.

5-3-9 MODE SELECT switch (8)

The handle feed, manual feed, reference point return (zero return), manual data input (MDI), memory operation, tape editing, and stroke end release (OT release) can be selected with this switch.



* HANDLE FEED

This makes possible the operation of the manual pulse generator (11). (Set the switch (9) to one of the positions of MULTIPLIER (X1, X10, X100).)

* JOG FEED

The jog feed can be operated for each axis in both directions of X and Z by the manual feed lever (12).
In this case, the jog feedrate can be selected either by the position of RAPID TRAVERSE or JOG of the feed mode select switch (9).

* ZERO RETURN (Reference point return)

Returning to the reference point is possible by operating the manual feed lever (12). When the reference point return is completed, the indicator lamps (13) are lighted on.

* MDI (Manual data input)

The program of the same format as for the tape command can be input manually to run the machine.

* MEMORY (Memory operation) ... LJ-63M, 103M
* AUTO (Automatic operation) ... LJ-62, 102, 62M, 102M

The cycle operation can be made by the CNC commands stored in the memory. (For details, refer to the Operator's manual of FANUC SYSTEM 10T-A.)

* EDIT (Tape editing)

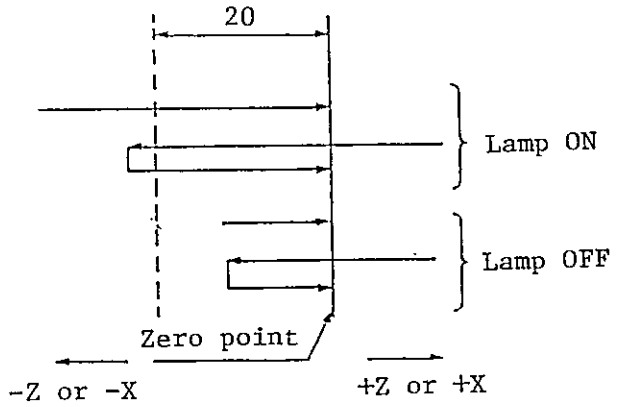
Editing of the data stored in the memory can be done. (For details, refer to the Operator's manual of FANUC SYSTEM 10T-A.)

* O.T. RELEASE (Stroke end release)

When an axis is reached to the stroke end position accidentally, select this position with the mode select switch (8), and manipulate the manual feed lever (12) in the reverse direction of O.T. (stroke end) to release it.

Notes) 1. Zero point return of Z axis can not be done unless zero point return of X axis is completed.

2. The zero point return indicator lamps (13) illuminate under the following conditions.



8-5 Lubrication of tailstock

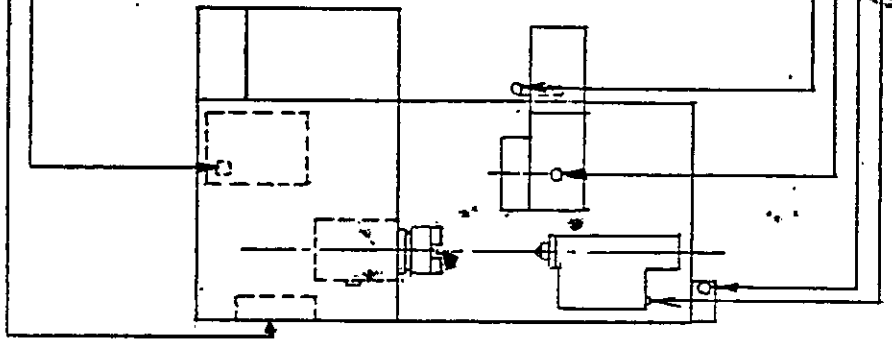
The lubrication of the sliding surfaces for the tailstock is to be carried out from two ball-type oil cups. The tailstock sleeve is lubricated automatically.

Note) It is recommended to replace the oil from the spindle drive gear box, the turret drive gear box, and the oil bath for lubricating the X axis ball screw 1 month later after starting the operation.

8-6 Kind of lubricants

Lubricants used for the machine are shown in the following table. It is recommended to observe them in order to maintain the accuracy.

①	MOBIL VACTRA OIL NO. 2 TONNA 68 ~~CERANA~~	SUPPLY TIMELY	
①	MOBIL VACTRA OIL NO. 2 TONNA 68	SUPPLY TIMELY	2 ℓ 0.6 gal
②	MOBIL DTE OIL TELLUS 32	CHANGE EVERY 6 MONTHS	5 ℓ 1.3 gal
②	MOBIL DTE OIL TELLUS 32	CHANGE EVERY 3 MONTHS	4 ℓ 1.0 gal
③	MOBIL GEAR 626 OMALA 68	CHANGE EVERY 6 MONTHS	10 ℓ 2.6 gal
②	MOBIL DTE OIL TELLUS 32	CHANGE EVERY 6 MONTHS	50 ℓ 13 gal



③ ~~OMALA 68~~ = CASTROL ALPHA SP68 GEAR OIL 20L PAIL (TRY HARD)

OR

③ KENOAL IN GEAR 68 $55.08 20L PAIL (S.B SIMPSON GROUP) 9/8/95

Fig. 8-1 Lubrication chart

② TELLUS 32 = HYSPIN AWS32 20L (ABOUT $2 PER L.) HYDRAULIC OIL, CASTROL (TRY HARD)

① TONNA 68 = WAYLUBE 20L (TRY HARD)

3. The automatic operation means the tape operation and the memory operation.

4. The machine can not be operated in the automatic operation unless the following conditions are satisfied in order to ensure the safety.

   A. The automatic operation can only be started with the X axis and Z axis at the machine zero point (with zero point return lamp (13) turned on). Therefore, it is recommended that the automatic zero point return G27 or G28 is programmed at the end of the operation.

   B. The machine is equipped with door interlock switches and the automatic operation can not be started unless the doors are closed in order to ensure the safety of the operators. For the trial operation, however, turning of the feed mode select switch (9) to "MULTIPLIER" releases the interlock.

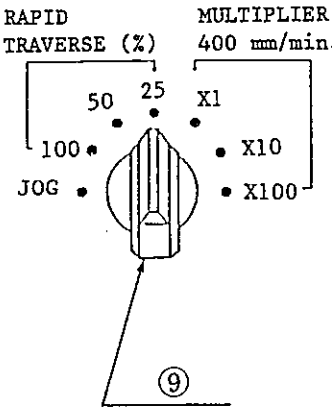
5. In case of MDI operation, it can be operated regardless of A and B above. Thus, special care must be taken for operation.

6. If the axis reaches to its stroke end, the alarm (O.T. alarm) is displayed on the CRT screen and the "READY" display disappears.

7. After releasing the axis from the stroke end, be sure to depress the "RESET" button and select a mode other than "O.T. RELEASE".

8. For the most part of over travelling of the axis, it suffices to feed the axis towards the reverse direction and depress the "RESET" button, without selecting the "O.T. RELEASE" mode.

5-3-10 FEED MODE select switch (9)



* The rapid traverse rate for the X axis, Z axis and C axis can be selected by this switch. When it is set to the "JOG" position, the feedrate override dial (10) becomes effective. For the manual operation, it is effective only when the mode select switch (8) is set to either "JOG FEED" or "ZERO RETURN".

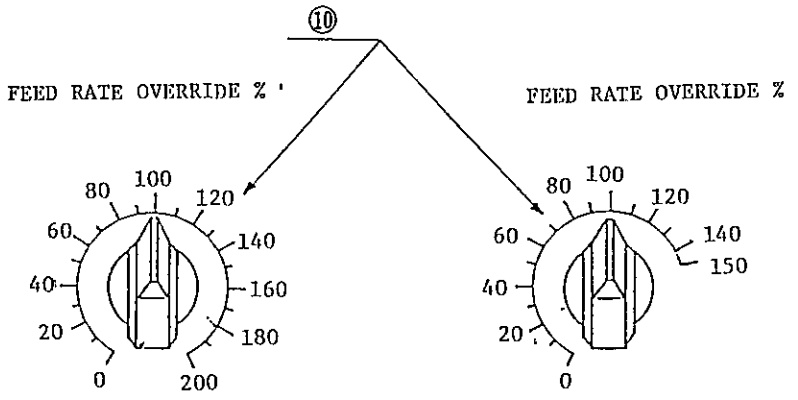
* By selecting one of the positions (X1, X10 or X100) of "MULTIPLIER" with this switch (9), the handle feed can be made with the manual pulse generator (11) after setting the mode select switch (8) to the "HANDLE FEED" position.

Position of feed mode select switch (9)		Manual pulse generator (11)	Manual feed lever (11) (X, Z axis)	C axis manual feed button (37)	G00 speed at automatic operation
JOG		Not effective	0 - 200% override is possible with feed rate override dial (10)		Not effective
RAPID TRAVERSE (%)	100	Not effective	Rapid traverse X axis: 8 m/min. (315 ipm) Z axis: 10 m/min. (394 ipm)	Rapid traverse C axis: 22.2 rpm (8000°/min.)	X axis: 8 m/min. (315 ipm) Z axis: 10 m/min. (394 ipm) C axis: 22.2 rpm
	50	Not effective	Rapid traverse X axis: 4 m/min. (157 ipm) Z axis: 5 m/min. (197 ipm)	Rapid traverse C axis: 11.1 rpm (4000°/min.)	X axis: 4 m/min. (157 ipm) Z axis: 5 m/min. (197 ipm) C axis: 11.1 rpm
	25	Not effective	Rapid traverse X axis: 2 m/min. (79 ipm) Z axis: 2.5 m/min. (98 ipm)	Rapid traverse C axis: 5.55 rpm (2000°/min.)	X axis: 2 m/min. (79 ipm) Z axis: 2.5 m/min. (98 ipm) C axis: 5.55 rpm
MULTIPLIER 400 mm/min.	X1	Effective (Refer to 5-3-12)	X axis: 400 mm/min. (16 ipm) Z axis: 400 mm/min. (16 ipm) C axis: Constant value preset in the control box		
	X10				
	X100				

Notes) 1. For setting-up operation, make sure to set the feed mode select switch (9) to the "MULTIPLIER 400 mm/min." position for the safety.

2. The machine is equipped with the door interlock switches as standard in order to ensure the safety of the operators. The automatic operation can not be started unless the doors are closed. When the door is opened during the automatic operation, the machine will stop at feed hold condition (temporary stop).
Therefore, when it is necessary to work with door opened in such case as compensating the tool, set the switch (9) to the "MULTIPLIER 400 mm/min." position. In this case, the door interlock is released.
Pay attentions to the cutting chips and splashing of the coolant. When the machine is stopped at feed hold condition because the door is opened accidentally during the automatic operation, the automatic operation can be restarted by depressing the cycle start button (3) after closing the door and confirming that the tools and other parts are not damaged.

5-3-11 FEED RATE OVERRIDE dial (10)



In case of LJ-63M, 103M

In case of LJ-62, 102, 62M, 102M

The feedrate of the X axis, Z axis and C axis can be overriden by this override dial (10) during the automatic operation and the manual feed. In the automatic operation, the override can be done for the designated cutting feed in the range as follows:

F○○○○ x (0 ~ 200%) ... In case of LJ-63M, 103M
F○○○○ x (0 ~ 150%) ... In case of LJ-62, 102, 62M, 102M

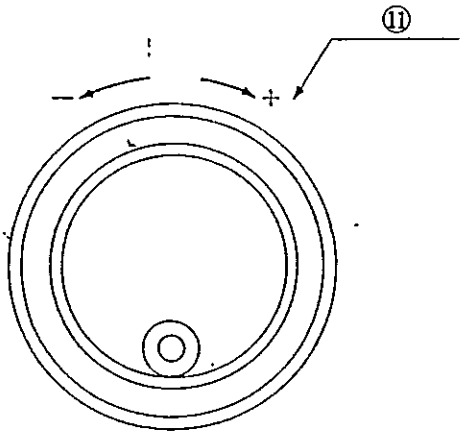
by the step of 10%.
But, for the automatic operation, 100% is to be selected as standard. Check this before starting the machine.

Notes) 1. The feedrate override is not effective during thread cutting.

2. In the manual operation, the feedrate override is related to the "JOG" of feed mode select switch (9).

3. Refer to the Operator's manual of FANUC SYSTEM 10T-A for other details.

5-3-12 Manual pulse generator (11)

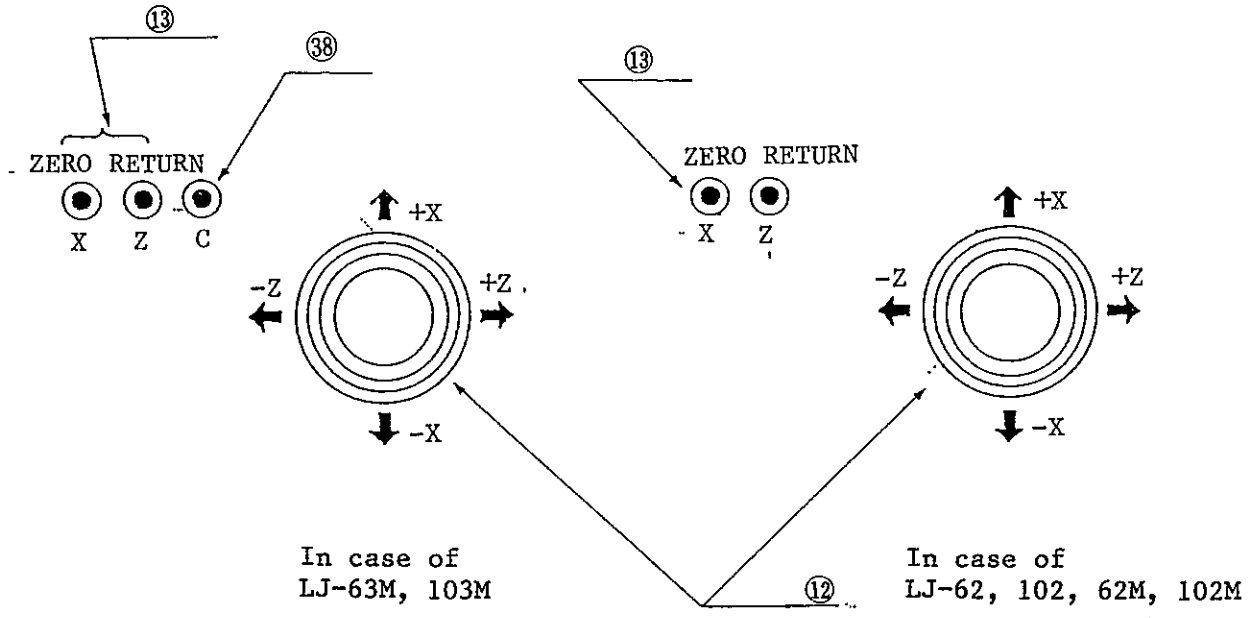


After selecting the "HANDLE FEED" with the mode select switch (8) (either X or Z axis, or in case of 3 axis machine, C axis) handle feed can be done to the desired direction by turning the manual pulse generator (11) either right or left. The feeding amount is dependent on the selecting position of the feed mode select switch (9) and as follows:

Position of feed mode select switch (9)	Position of mode select switch (8)	
	Feeding amount by manual pulse generator (11)	
X1	0.001 mm (0.0001 in.) per graduation	0.001 deg. per graduation
X10	0.01 mm (0.001 in.) per graduation	0.01 deg. per graduation
X100	0.1 mm (0.01 in.) per graduation	0.1 deg. per graduation

5-3-13 Manual feed lever (12)

5-3-14 X and Z axis zero return indicator lamps (13)
(C axis zero return indicator lamp (38) is provided for 3 axis machine.)

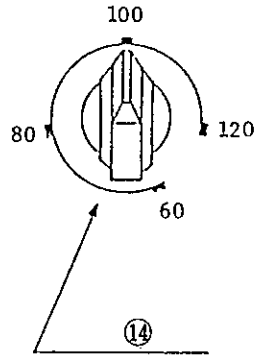


* Set the mode select switch (8) to "JOG FEED" and the feed mode select switch (9) to the specified position, then, the manual feed lever (12) is effective and the turret can be moved with the feedrate specified by the switch (9). (For the C axis, refer to the paragraph 5-5-3.)

* Set the mode select switch (8) to "ZERO RETURN", tilt the manual feed lever (12) in +X and then, +Z axis directions, the turret makes zero point return with the feedrate specified by the switch (9) and, the X and Z axis zero return indicator lamps (13) light up for each axis. (For the C axis, refer to the paragraph 5-5-3.)

5-3-15 SPINDLE OVERRIDE dial (14)

SPINDLE OVERRIDE %



* During the automatic operation, it is possible to apply the override in the range of 60 to 120% against the specified main spindle speed or the milling spindle speed.
(But, the overriden speed can not exceed the maximum speed of the machine.)

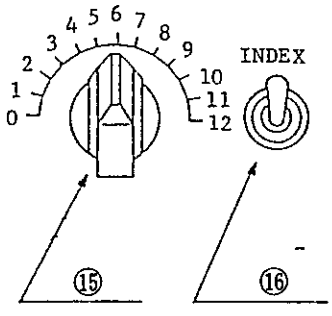
* For the automatic operation, 100% is the standard and it is necessary to confirm this before starting the machine.

Note)
The selection of the main spindle or the milling spindle is done automatically when the corresponding M functions are read out.

5-3-16 TOOL SELECT switch (15)

5-3-17 TOOL INDEX switch (16)

TOOL SELECT



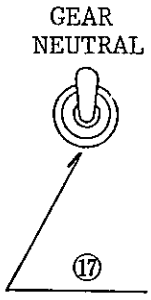
* When it is required to index the turret manually for setting tools or replacing inserts, select the manual mode by the mode select switch (8) and select the required tool No. (1 ~ 12) by the tool select switch (15), then switch on the turret index switch (16). The turret indexes to the required position.

* When the tool select switch (15) is set to the "0" position, the turret rotates while the index switch (16) is depressed, and so, any tool can be selected.

Notes) 1. The manual mode of the mode select switch (8) means either the "JOG FEED", "ZERO RETURN" or "HANDLE FEED".

2. When selecting the "0" position by the tool select switch (15) and operating the turret index switch (16), it is possible to index each station step by step.

5-3-18 GEAR NEUTRAL switch (17)

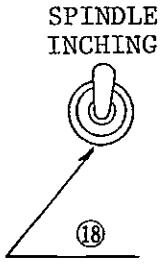


* By operating the switch (17) after selecting the manual mode (ZERO RETURN, JOG FEED or HANDLE FEED) with mode select switch (8), the spindle gear can be shifted to the neutral.

* To rotate the spindle (by S function and M function) after performing the above operation, command M40 (Spindle low gear) or M41 (Spindle high gear) by MDI or TAPE command for engaging the spindle gear.

* If no command about spindle gear change (M40, M41) is given, the machine stops as feed hold condition (temporary stop) when S function is read out.

5-3-19 SPINDLE INCHING switch (18)

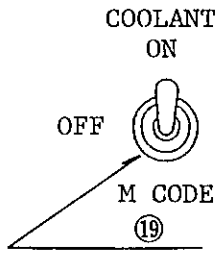


* For inching the spindle, select the manual mode (ZERO RETURN, JOG FEED or HANDLE FEED) with the mode select switch (8). The spindle rotates clockwise while this switch (18) is being depressed. The rotational speed is preset to the constant rate inside the control box.

Note)

When the spindle CW or CCW command is stored in the memory, the inching operation can not be performed. Therefore, it is necessary to command M05 (spindle stop) first and then carry out the inching operation.

5-3-20 COOLANT switch ⑲



* "COOLANT ON", "M CODE" or "OFF" can be selected by this switch ⑲.

* "COOLANT ON"
  The coolant is supplied from each nozzle on the turret, on the ceiling regardless of the automatic operation or not.

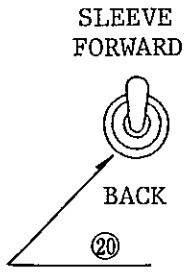
* "M CODE"
  The coolant is supplied from each nozzle when the M08 (coolant ON command) is given during the automatic operation. The coolant stops when the M09 (coolant OFF command) is given.

* "OFF"
  The coolant is stopped regardless of the automatic operation or not.

Notes) 1. The coolant switch ⑲ can be operated in any mode.

2. The coolant can be turned off by this switch even when the coolant ON command (M08) is given by the program during the automatic operation.

5-3-21 SLEEVE (quill) switch (20)



* The tailstock sleeve can be moved forward and back by operating this switch.
  This switch is effective in all modes of the switch (8) except during automatic operation.

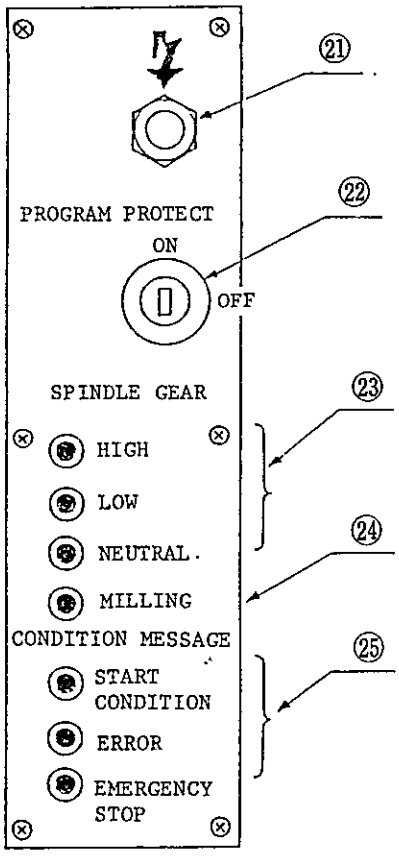
* "FORWARD"
  When the switch is tilted to the "FORWARD" side once, the tailstock sleeve advances and stops at the forward stroke end.

* "BACK"
  The tailstock sleeve recedes only while the switch is being tilted to the "BACK" side. The tailstock sleeve stops as soon as the switch is released.

Notes) 1. If the M33 command is given by mistake while the spindle is stopping in the automatic operation, the tailstock sleeve retracts. But, during the automatic operation, the tailstock sleeve does not recede even if the switch (20) is tilted to "BACK".

2. In case of shaft work, chuck the workpiece once and move the tailstock sleeve forward by the switch (20) or M command, and then unclamp and clamp the chuck jaws once more in order to clamp the workpiece correctly.

3. The tailstock sleeve can be moved forward and backward by the M command. (For the details, see the Programming manual.)



5-3-22 POWER ON indicator lamp (21)

* This lamp (21) lights up when the "NO FUSE BREAKER" of the control box is turned on.

5-3-23 PROGRAM PROTECT key switch (21)

* This switch is used when editting (inserting, deleting or altering) the CNC programs stored in the memory.

* "ON"

When this switch is turned on, the editting of CNC commands can not be made even if the mode select switch (8) is set to EDIT mode.
On the other hand, the "ORIGIN" operation of the coordinate value on CRT display can not be executed with this key switch turned on for the automatic operation mode (MDI, MEMORY, AUTO, EDIT), but not so for the manual mode (HANDLE FEED, JOG FEED, ZERO RETURN).

Note) In case of LJ-63M, and LJ-103M, the above operation is possible for all modes, manual and automatic.

* "OFF"

When this switch is turned off, the editing of CNC programs can be made with the mode select switch (8) set to "EDIT". The "ORIGIN" operation on the CRT display can also be done for all modes.

Note) In case of automatic operation, it should be set to "ON" usually.
Therefore, confirm this before starting the cycle operation. For details, see the Operator's manual of FANUC SYSTEM 10T-A.

5-3-24 SPINDLE GEAR POSITION indicator lamp (23)

* With M40 (Spindle gear low speed range) or M41 (Spindle gear high speed range) command, the "LOW" or "HIGH" lamp lights up.

* With the operation of spindle gear neutral switch (17), the "NEUTRAL" lamp lights up indicating that the spindle is in the neutral condition.

5-3-25 Milling indicator lamp (24)

* In case of LJ-63M, 103M
By the command of M54 (C axis gear ON) with MDI or in the program or, by the manual operation of C axis clutch ON (See the paragraph 5-5-1.), this lamp is turned on indicating that the milling operation is ready to start.

* In case of LJ-62M, 102M
By the command of M52 (Spindle lock ON) with MDI or in the program, this lamp is lit and indicates that the milling is possible.

* In case of LJ-62, 102
The machine is not provided with this lamp.

5-3-26 CONDITION MESSAGE lamps (25)

* "START CONDITION"
The automatic operation of the machine can be made when this lamp is being lighted.

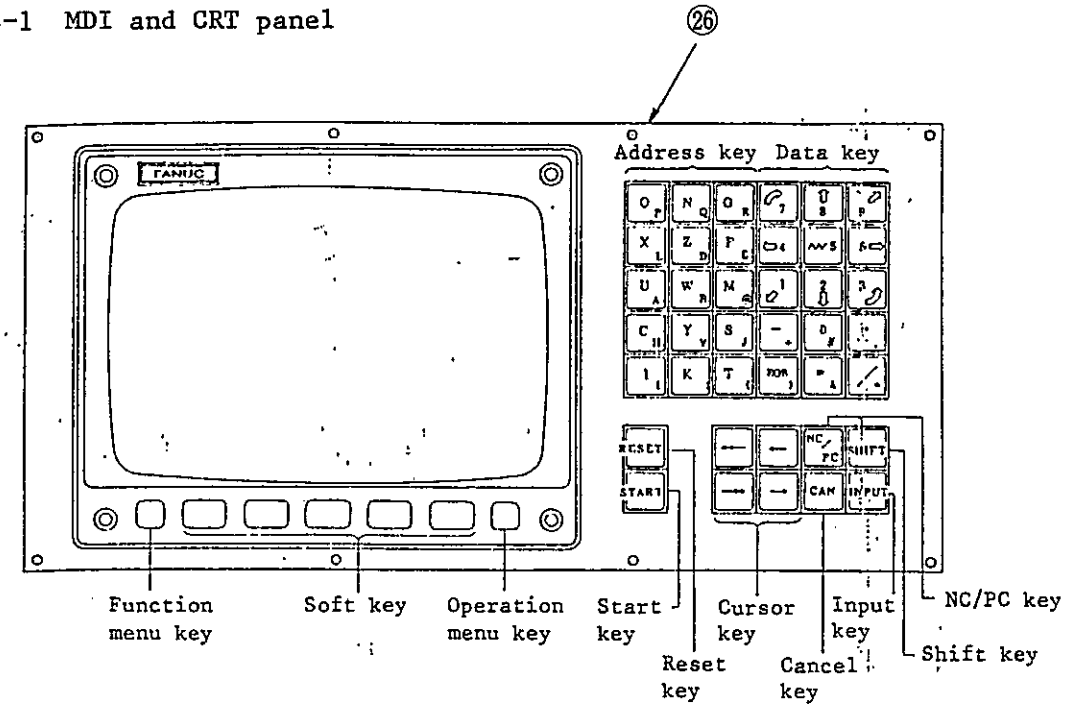
* "ERROR"
When this lamp is lighted, it indicates the operation mistakes.

* "EMERGENCY STOP"
When this lamp is lighted, it indicates that the machine is in the emergency stop. Find out the cause and eliminate it.

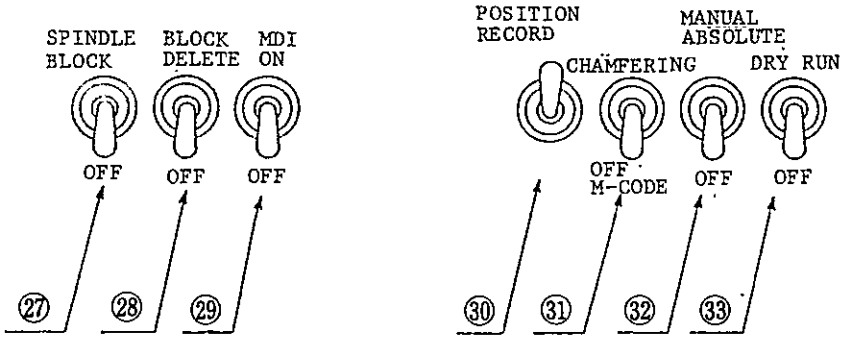
Note) For the details, refer to the paragraph 9-7.

5-4 CNC unit

5-4-1 MDI and CRT panel



Note) For the details on the MDI and CRT panel, refer to the Operator's manual of FANUC SYSTEM 10T-A.
It is especially noted that the soft keys are multi-purpose keys whose functions are switched by other keys. Therefore, a special care should be taken when operating these keys and, it is recommended to depress the soft keys step by step by confirming the CRT display.



5-4-2 SINGLE BLOCK switch (27)

* After setting this switch to "SINGLE BLOCK" position, depress the cycle start button, then, the machine starts and stops after completion of one block of the program. The next block can be executed by depressing the cycle start button once again.

* When the switch is set to "OFF", the machine executes the program continuously.
(For details, refer to the Operator's manual of FANUC SYSTEM 10T-A.)

5-4-3 BLOCK DELETE switch (28)

* When this switch is set to "BLOCK DELETE", the informations of blocks with slash (/) in the program are neglected.

* When this switch is set to "OFF", all informations of blocks are read out.

Note) During automatic operation, switching of this switch may cause a program error in some cases.
(For the details, refer to the Operator's manual of FANUC SYSTEM 10T-A.)

5-4-4 OPTIONAL STOP (M01) switch (29)

* When the M01 switch is set to "ON" and if M01 is programmed, the machine stops immediately (temporary stop) after reading M01. Depress the cycle start button (3) for restarting.

* When the switch is set to "OFF", the M01 commands in the program are ignored and the program proceeds to the next block. (For details, refer to the Operator's manual of FANUC SYSTEM 10T-A.)

5-4-5 POSITION RECORD switch (30)

* As for the operation of this switch, refer to the Operator's manual of FANUC SYSTEM 10T-A.

5-4-6 CHAMFERING switch (31)

* When this switch is set to "CHAMFERING", chamfering of thread in all of the thread cutting cycles is done.

* With this switch set to "OFF, M CODE", no chamfering is made during threading. However, the chamfering of thread can be made by M command (M48) in the program.

5-4-7 MANUAL ABSOLUTE switch (32)

* By setting this switch to "MANUAL ABSOLUTE", absolute counter operates even in manual operation so that the absolute position display change by the amount of manual movement. Therefore, if the machine is moved manually during automatic operation, it can be returned to the initial position by commanding the absolute coordinate reading with MDI.

* When this switch (32) is turned off, the absolute counter will not operate during manual operation, so that the coordinate system can be shifted by the amount of movement.

Note) Using this function is very dangerous, it is recommended to use it only after understanding the descriptions in the Operator's manual of FANUC SYSTEM 10T-A.

5-4-8 DRY RUN switch (33)

* During automatic operation with "AUTO", "MDI" or "MEMORY" mode, if this switch is set to "DRY RUN", F functions commanded by CNC tape etc., are ignored and it behaves as follows.

* In case of cutting feed command (G01)

  With feed mode select switch (9) at "JOG"
  ..... Set value of feedrate override dial (10).

  With feed mode select switch (9) at "RAPID TRAVERSE"
  ..... Set values of rapid traverse override
  (400 mm/min., 25%, 50%, 100%)

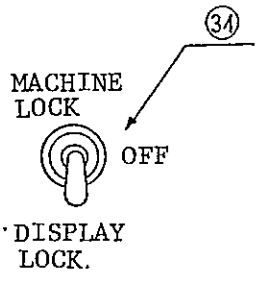
* In case of rapid feed command (G00)

  With feed mode select switch (9) at "JOG"
  ..... Set value of feedrate override dial (10) with
  520 mm/min. as 200% (Differ from JOG feedrate).

  With feed mode select switch (9) at "RAPID TRAVERSE"
  ..... Set value of rapid traverse override
  (400 mm/min. 25%, 50%, 100%)

  Note) Using this function is very dangerous, be careful of its operation.
  It is necessary to remove the workpiece when using this function.

5-4-9 MACHINE LOCK switch (34)



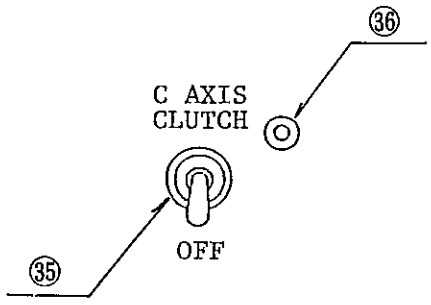
* "MACHINE LOCK"
  Without running the machine, the operation can be made as if the machine were moving with this switch set to "MACHINE LOCK". Therefore, the display indicates as if the machine were running. This function is used to check the program, but S, T and M functions are performed.

* "DISPLAY LOCK"
  With this setting, the machine can be moved while the display of the relative coordinate values does not change. This is used for example when the coordinate system is to be shifted by manual feed and the shift amount is not to be entered into the display.

5-5 C axis operation (only for LJ-63M, 103M)

5-5-1 C AXIS CLUTCH switch (35)

5-5-2 C AXIS CLUTCH ON indicator lamp (36)

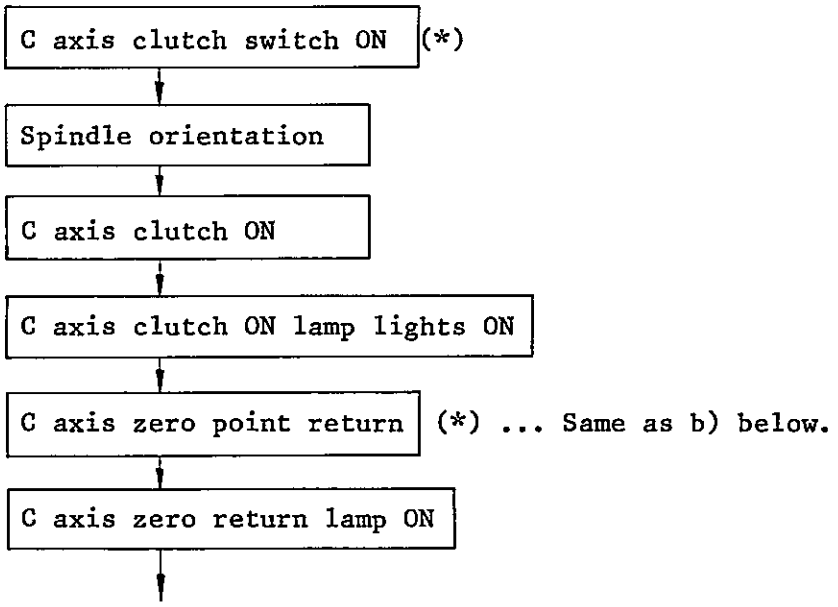


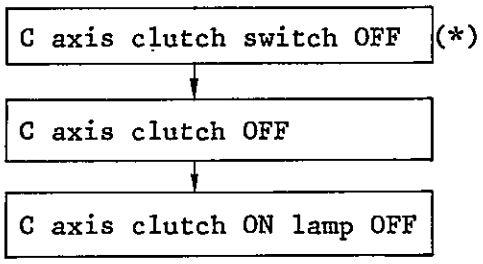
* The C axis clutch switch (35) is used to switch the C axis clutch on and off in manual operation.
The C axis clutch ON lamp (36) goes on and off until the C axis clutch is engaged completely and then, illuminates.

Notes) 1. The manual mode (ZERO RETURN, JOG FEED OR HANDLE FEED) should be selected by the mode select switch (8) to operate the switch (35).

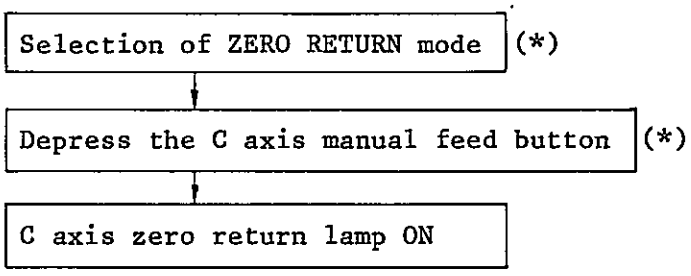
2. The relations between the C axis clutch switch (35), the C axis manual feed button (37), and others are as follows.

a) C axis clutch ON/OFF in manual operation


C axis clutch switch ON
(*)
Spindle orientation
C axis clutch ON
C axis clutch ON lamp lights ON
C axis zero point return
(*) ... Same as b) below.
C axis zero return lamp ON



b) C axis reference point return in manual operation

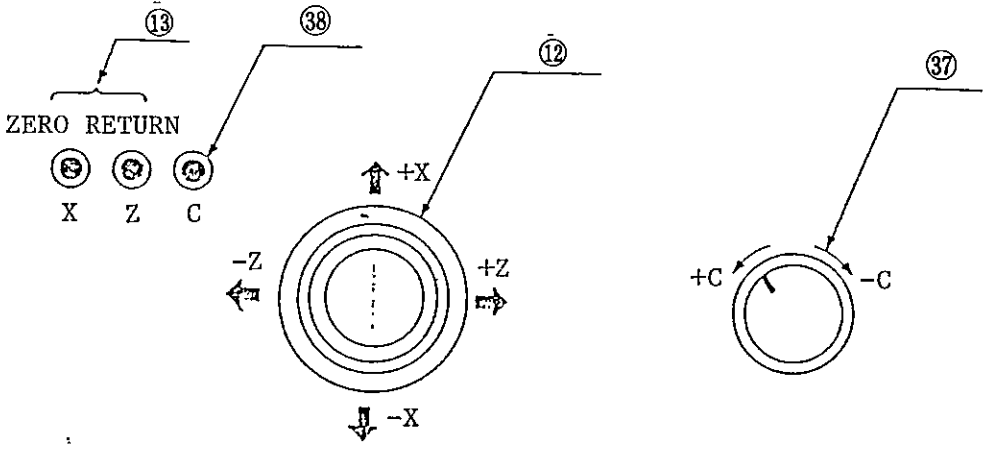


Remark) (*) means the manual operation.
For automatic operation, refer to the Programming manual.

3. C axis clutch OFF is not possible unless after execution of C axis reference point return.

5-5-3 C axis manual feed button (37)

5-5-4 C axis zero return indicator lamp (38)



* After switching on the C axis clutch manually or by M54 command (C axis clutch ON), the C axis can be fed by depressing the C axis manual feed button (37).

* The relations between the mode select switch (8) and the C axis manual feed button (37) are as follows.

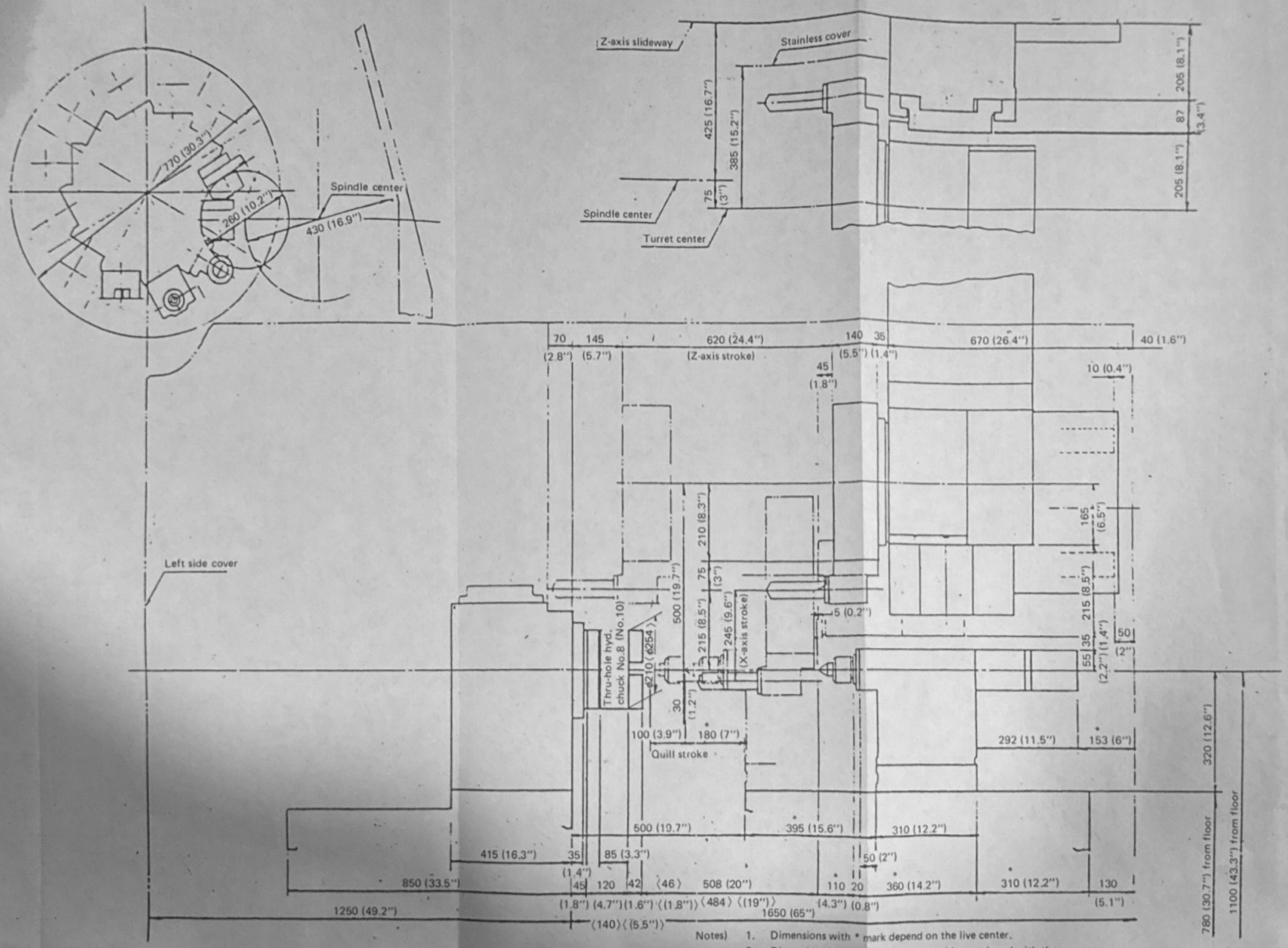
Position of mode select switch (8)		Operation of C axis manual feed button (37)	C axis zero return indicator lamp (38)
Manual mode	Handle feed	Impossible	OFF
	Jog feed	C axis rotates with the speed set by the feed mode select switch (9) while the button (37) is being depressed.	OFF
	Zero return	C axis returns to the zero point with the speed set by the feed mode select switch (9) if the button (37) is kept depressed.	ON

Notes) 1. In order to return the C axis to the reference point, keep depressing the C axis manual feed button (37) until the C axis zero return indicator lamp (38) is lit.

2. C axis reference point return can also be done by commanding G28 H-30. EOB (H means incremental command in C axis) in automatic operation.

6. FEED AXES

6-1 Work envelope (LJ-62, LJ-62M and LJ-63M)



Notes)
1. Dimensions with * mark depend on the live center.
2. Dimensions in < > are for the machine equipped with the throu-hole hyd. chuck No.10.
3. Please check, with a dial gauge, etc., the distance of 215mm (8.5 in.) between the spindle center to the boring holder center in case that the high accuracy is required especially.

6-3 Machine reference point

The machine reference point of the X axis is fixed at the position where the distance between the turret center and spindle center is 500 mm (19.69 in.).
The machine reference point of the Z axis can be adjusted by changing the dog setting position as follows:

LJ-62, 62M, 63M ..... 4 different positions by 80 mm (3-1/8") step.

LJ-102, 102M, 103M ... 4 different positions by 160 mm (6-5/16") step.

6-3-1 X axis reference point

The limit switch installed on the turret and the dogs attached to the cross slide are as shown below when the turret is returned to its machine reference point of X axis.

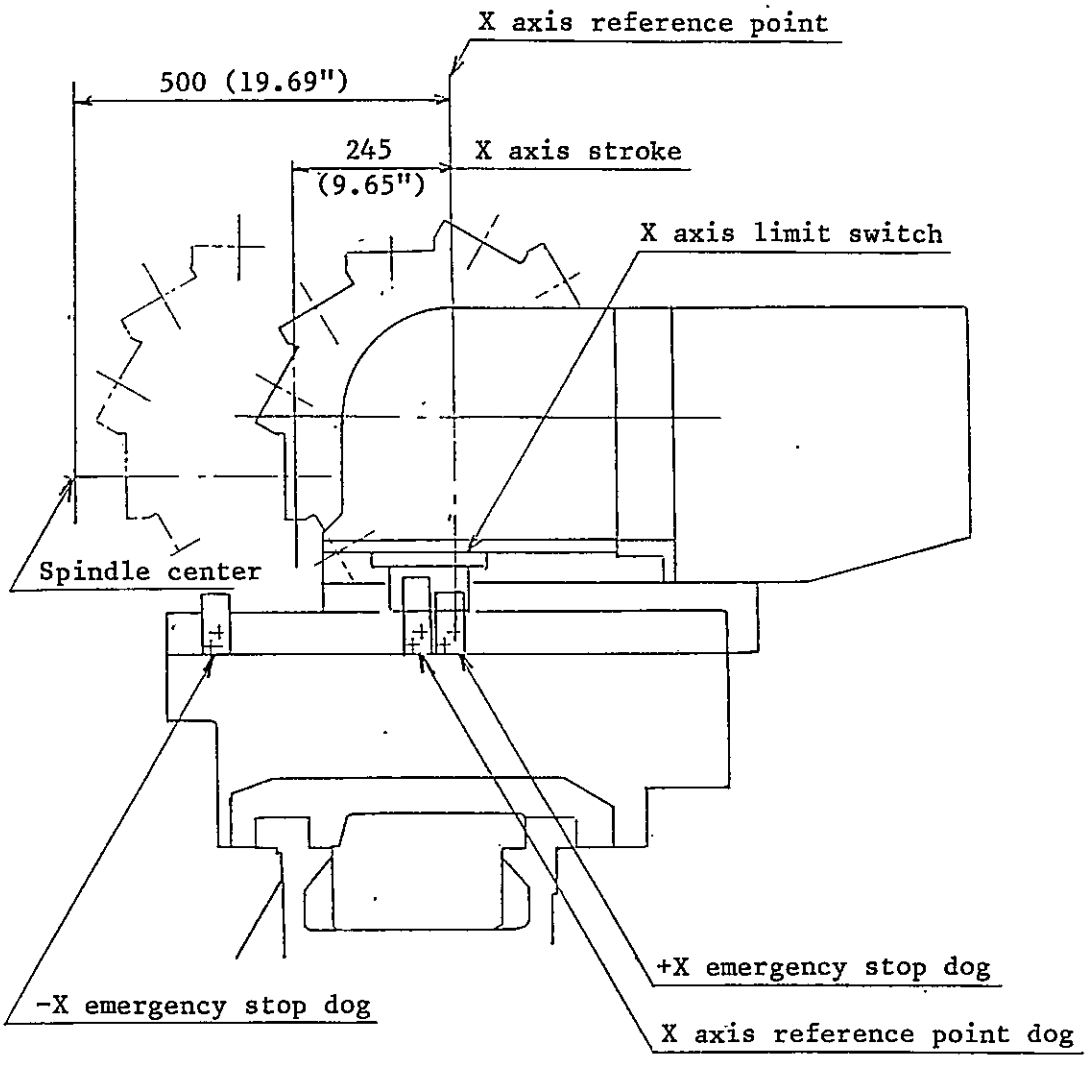


Fig. 6-1 X axis reference point

6-3-2 Z axis reference point

The following figure shows the rear view of the turret which is returned to its Z axis reference point.
Z axis reference point dog can be set at one of A, B, C or D positions. In this case, +Z emergency stop dog is also moved.
Distance (a) for each case is as follows:

Position of dog	LJ-62, 62M, 63M	LJ-102, 102M, 103M
A	720 mm (28.35 in.)	1120 mm (44.09 in.)
B	640 mm (25.20 in.)	960 mm (37.80 in.)
C	560 mm (22.05 in.)	800 mm (31.50 in.)
D	480 mm (18.90 in.)	640 mm (25.20 in.)

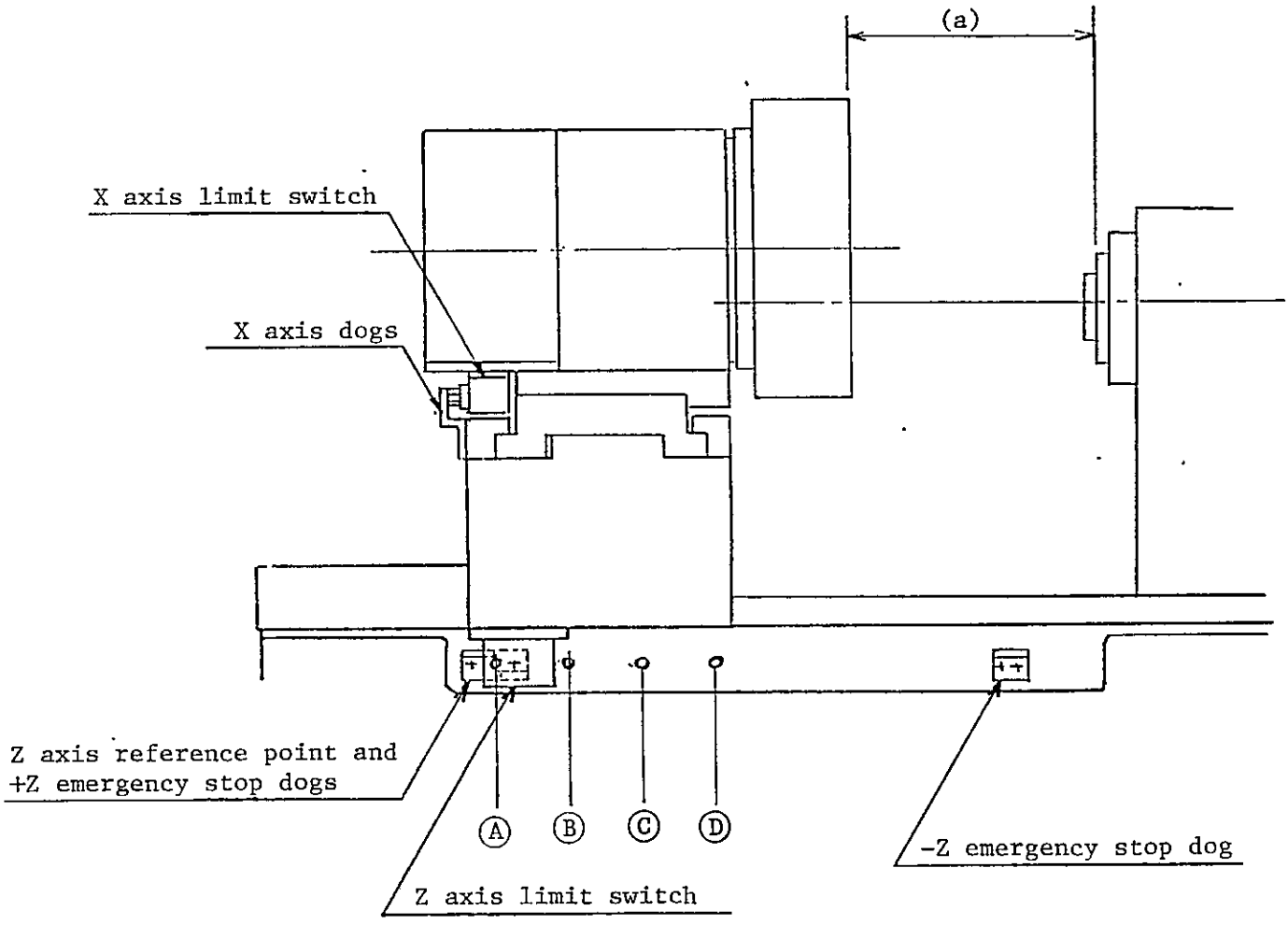


Fig. 6-2 Z axis reference point

6-4 Feed axes

6-4-1 Servo motor

CNC unit	Axis	Servo motor	Permissible thrust
FANUC SYSTEM 10T-A	X	FANUC AC motor Model 5	500 kg
	Z	FANUC AC motor Model 10	850 kg

6-4-2 Ball screw

	Lead	O.D.	Direc-tion	Linearbility	Balls	Preload	Accuracy
X axis	8 mm	36 mm	Right	±0.010/435 mm	2.5 turns (2 rows)	50 kg	C3Z
Z axis	12 mm	40 mm	Right	±0.025/800 mm	1.5 turns (2 rows)	100 kg	C5Z

6-4-3 Slideways

a) Slideways are hardened and ground
Longitudinal slideways are treated by induction hardening to HRC 52 or more and ground, and cross slideways to HRC 50 or more and ground.

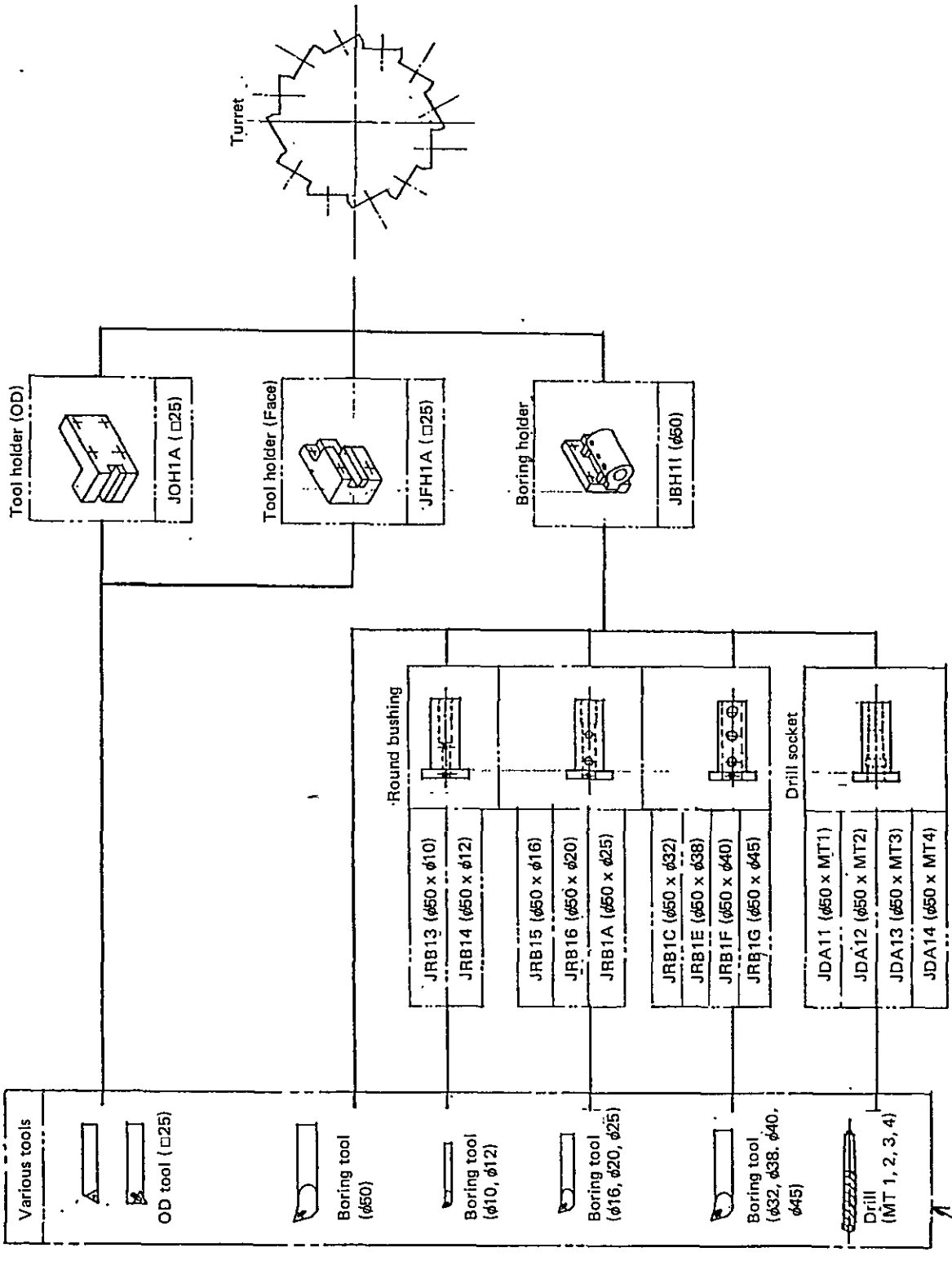
b) Lubrication
Constant amount of lubrication oil is supplied automatically to X and Z axis slideways, gear boxes, etc, for a specified interval of times (once every 15 minutes).
Once the lubrication oil tank is filled, no refilling is necessary for almost 20 days. (In case of 8 hours operation per day.)

c) Protection of slideways
X and Z axis slideways are completely protected with metallic covers to prevent the cutting chips from entering.

d) Oil bath lubrication system of X axis reduces thermal expansion of the ball screw to only 1/3 of usual system.

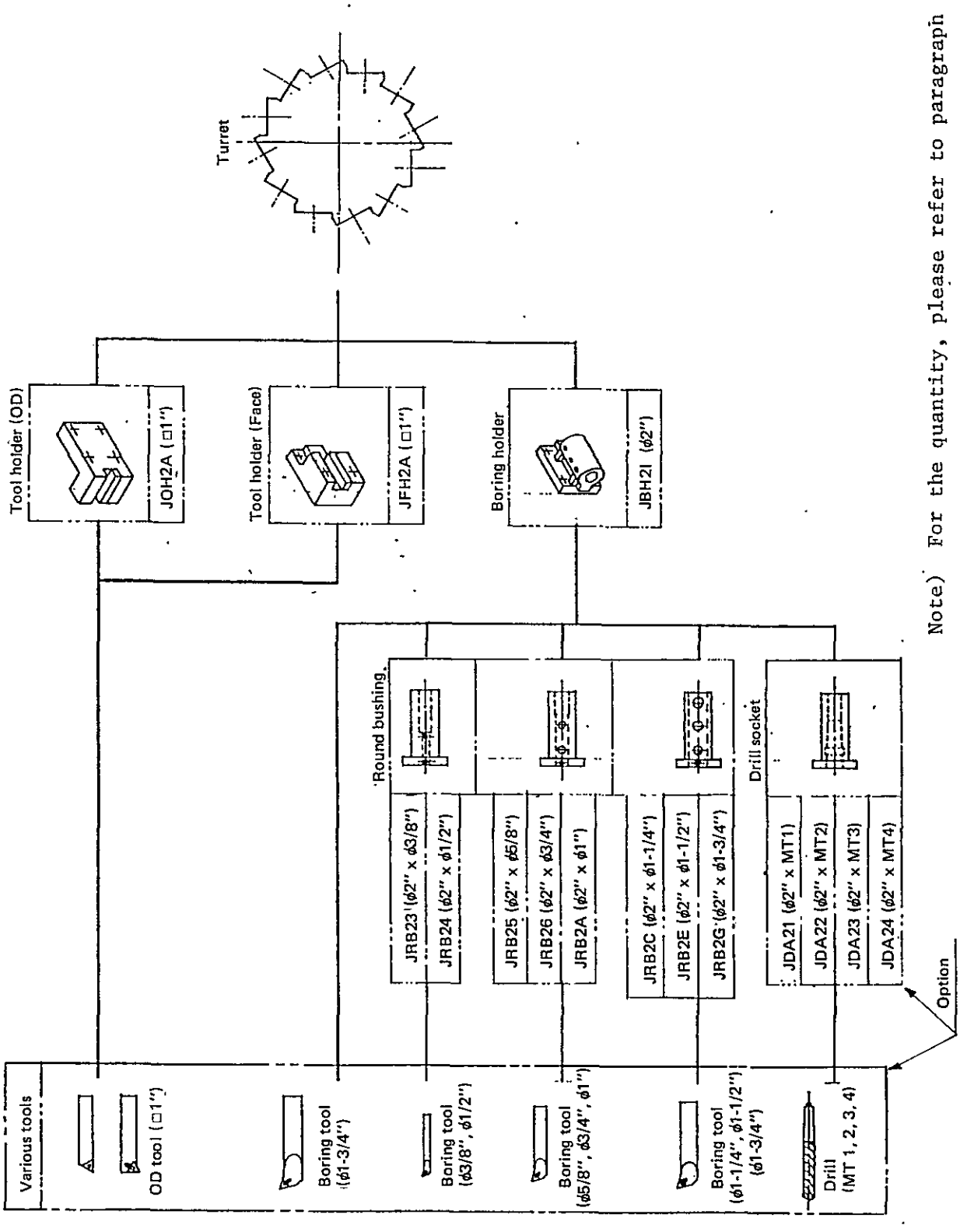
7. TOOLING SYSTEM

7-1 Turning tooling system (Metric)



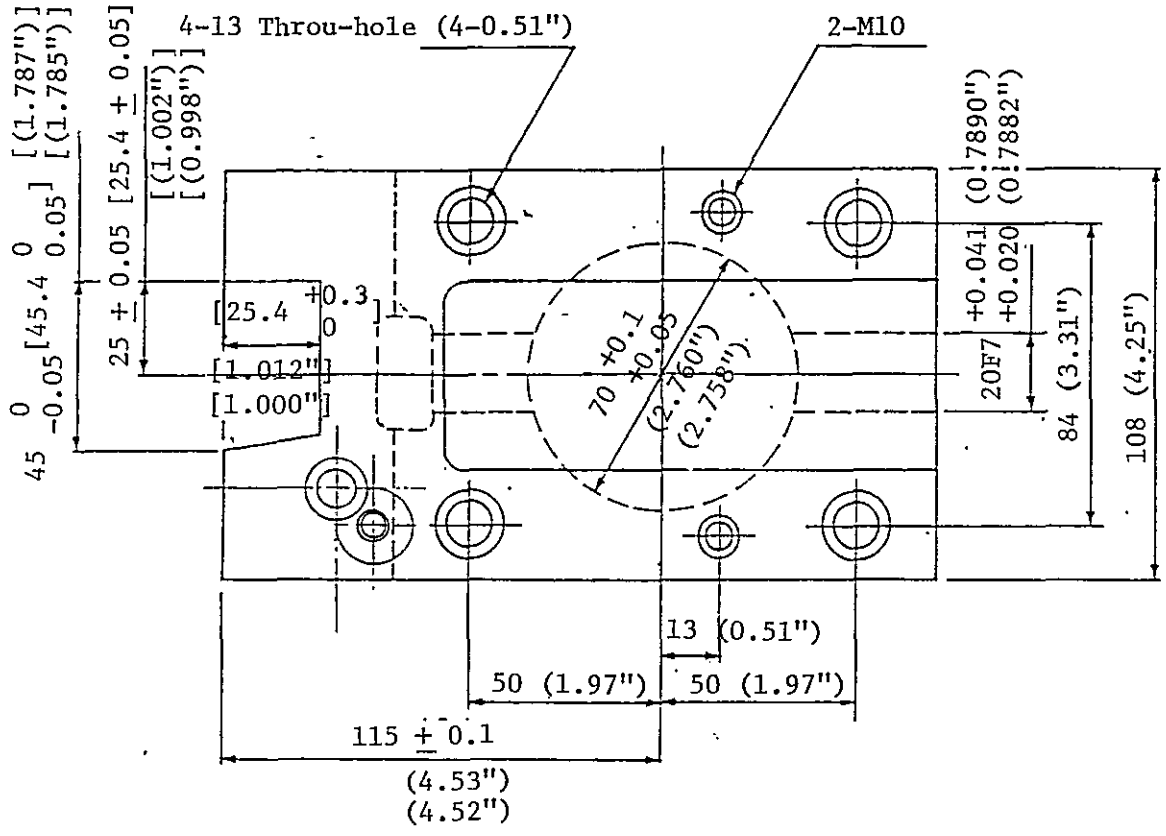
Note) For the quantity, please refer to paragraph 3-2.

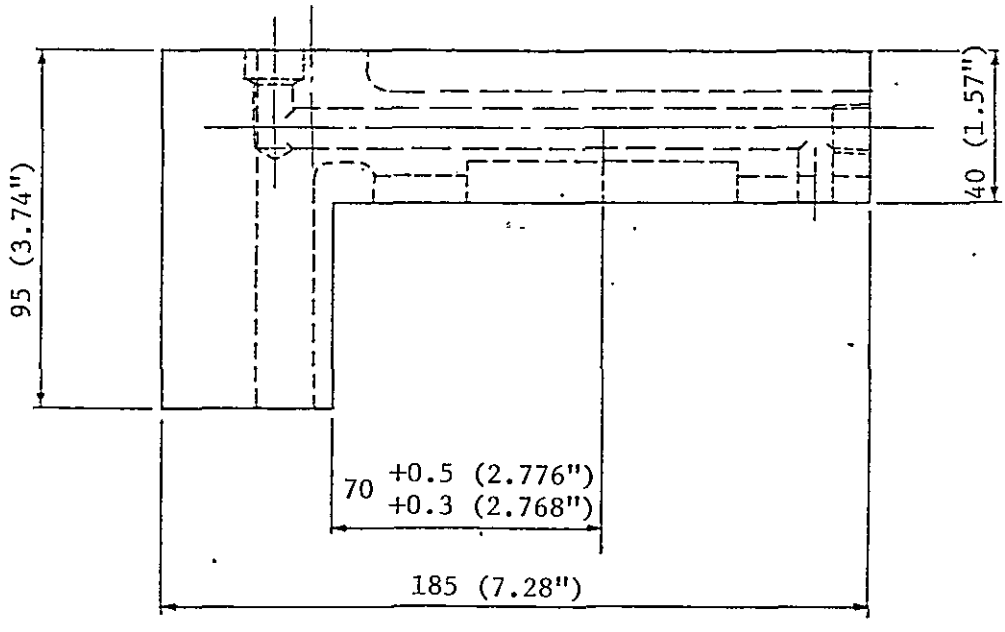
7-2 Turning tooling system (Inch)



Note) For the quantity, please refer to paragraph 3-2.

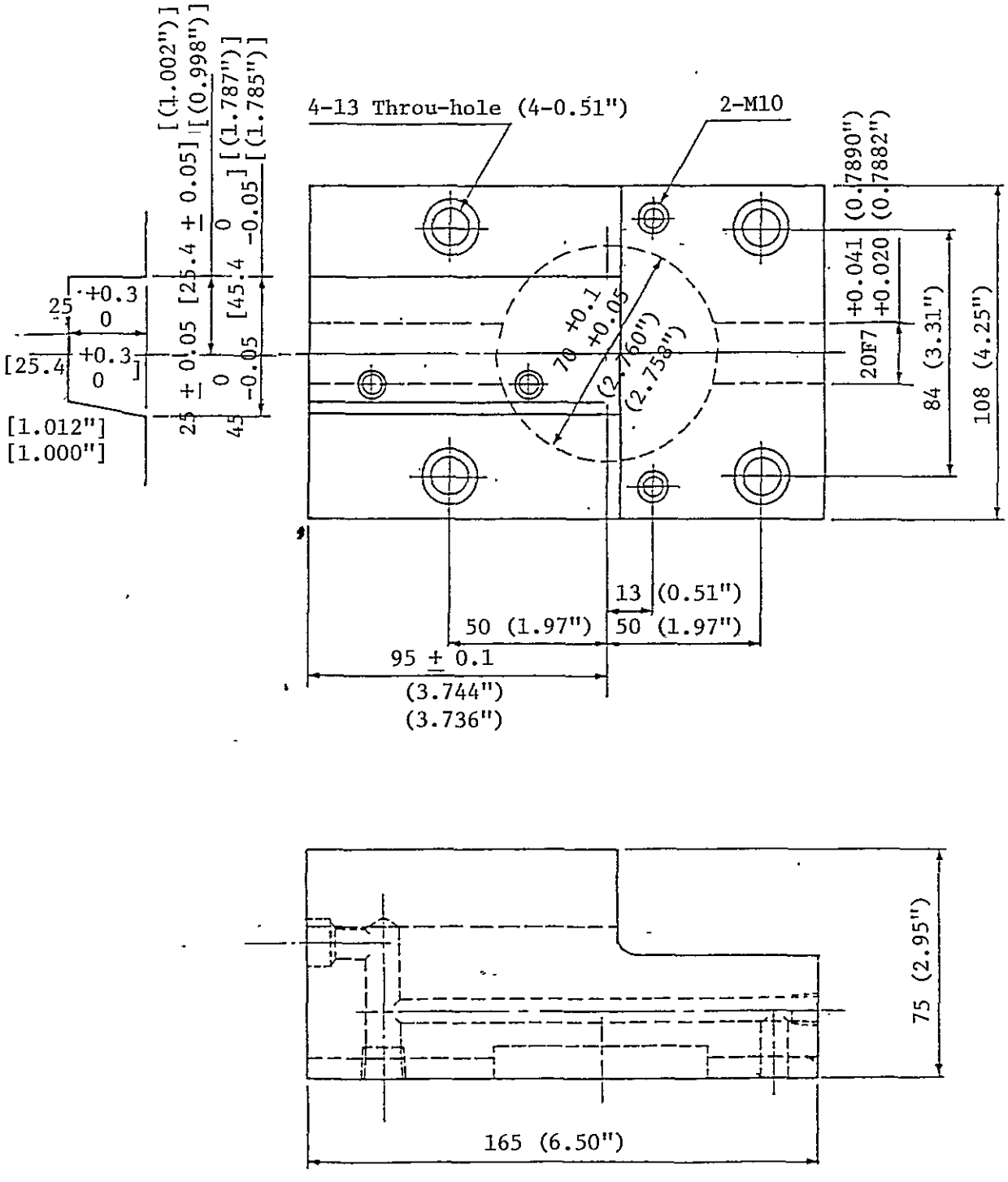
7-3 Tool holder for O.D. (JOH1A, JOH2A)





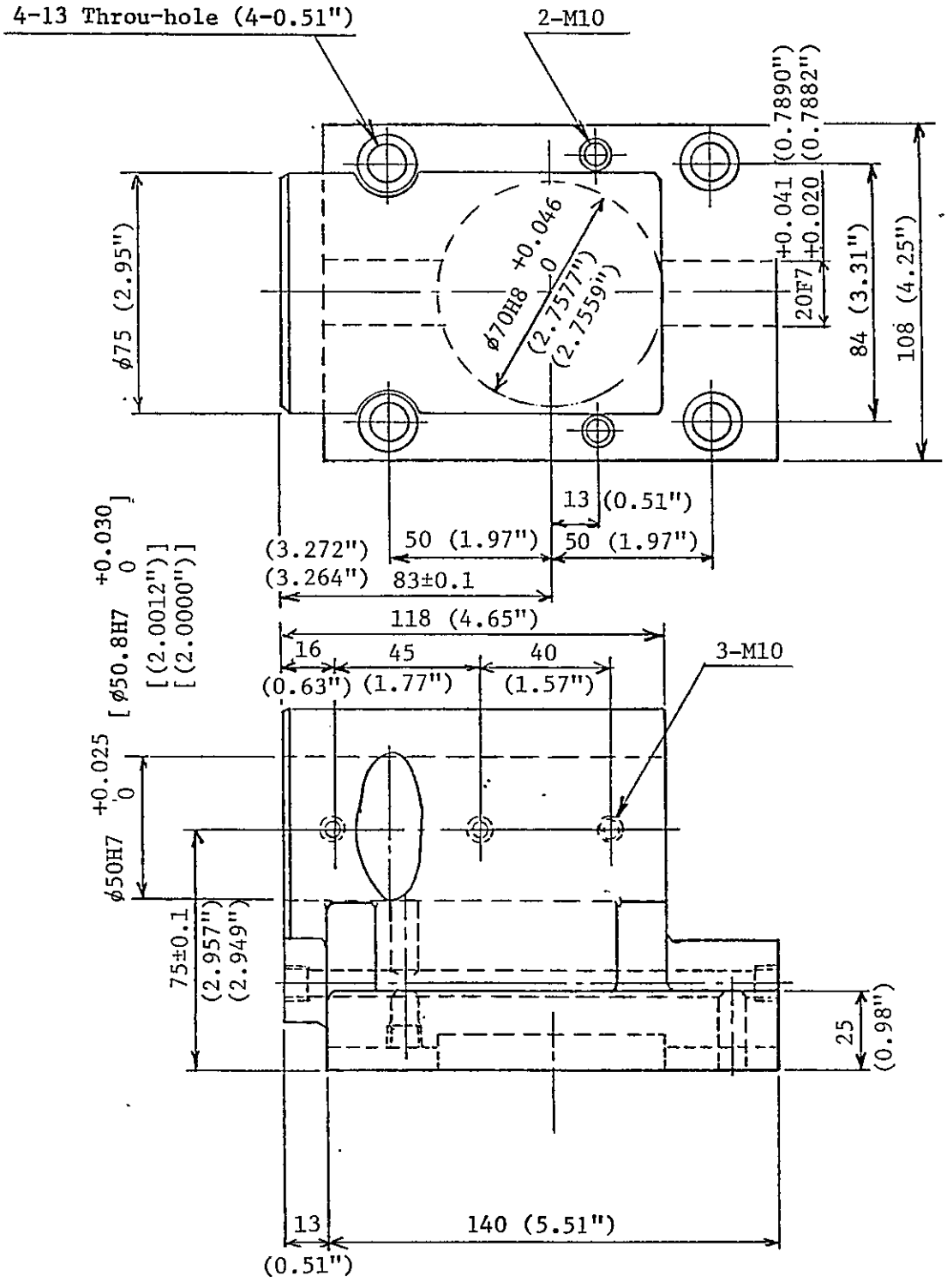
Note) Dimensions in [ ] are for inch tool holder JOH2A.

7-4 Tool holder for Face (JFH1A, JFH2A)



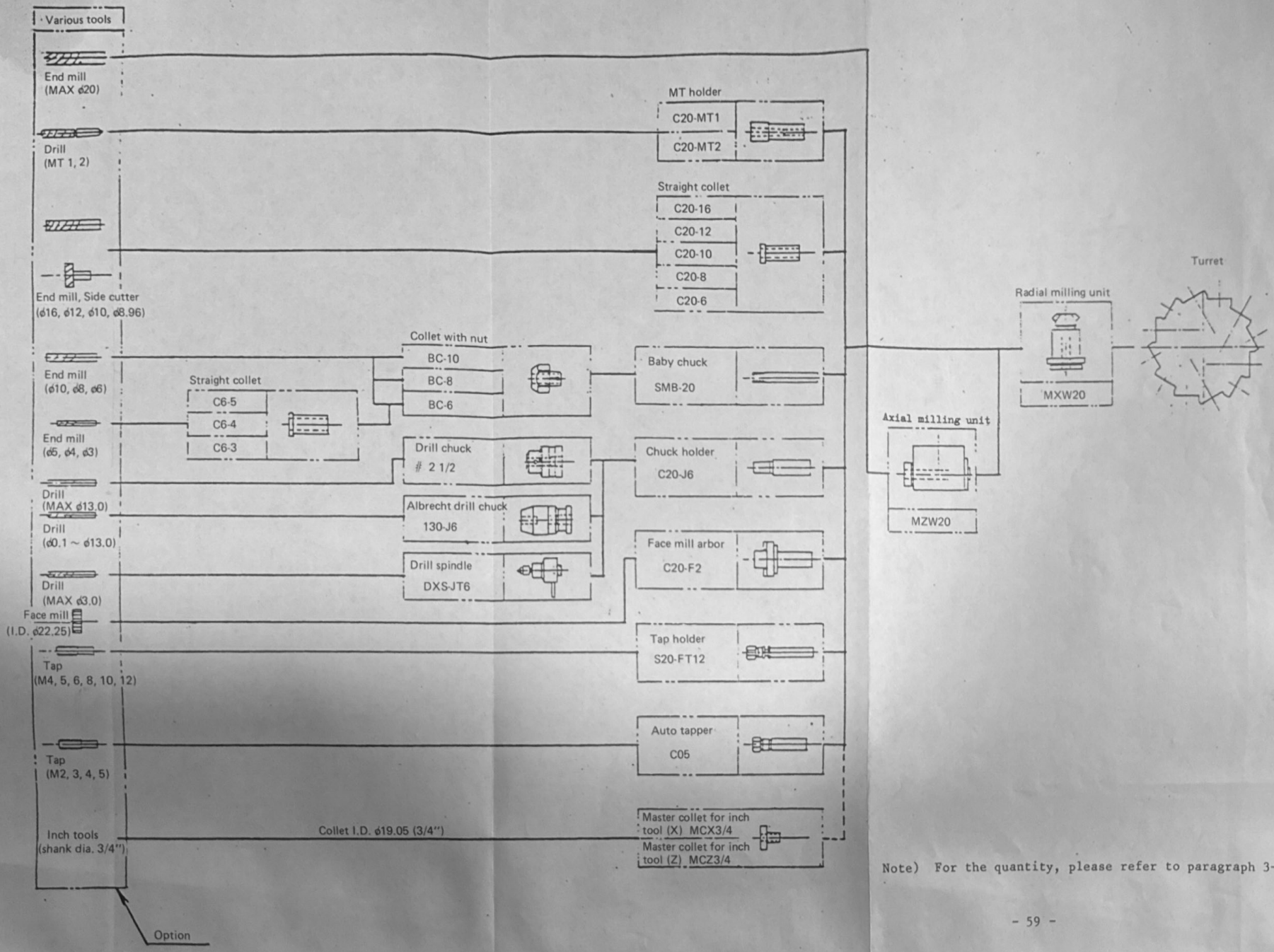
Note) Dimensions in [ ] are for inch tool holder JFH2A.

7-5 Boring holder (JBH1I, JBH2I)



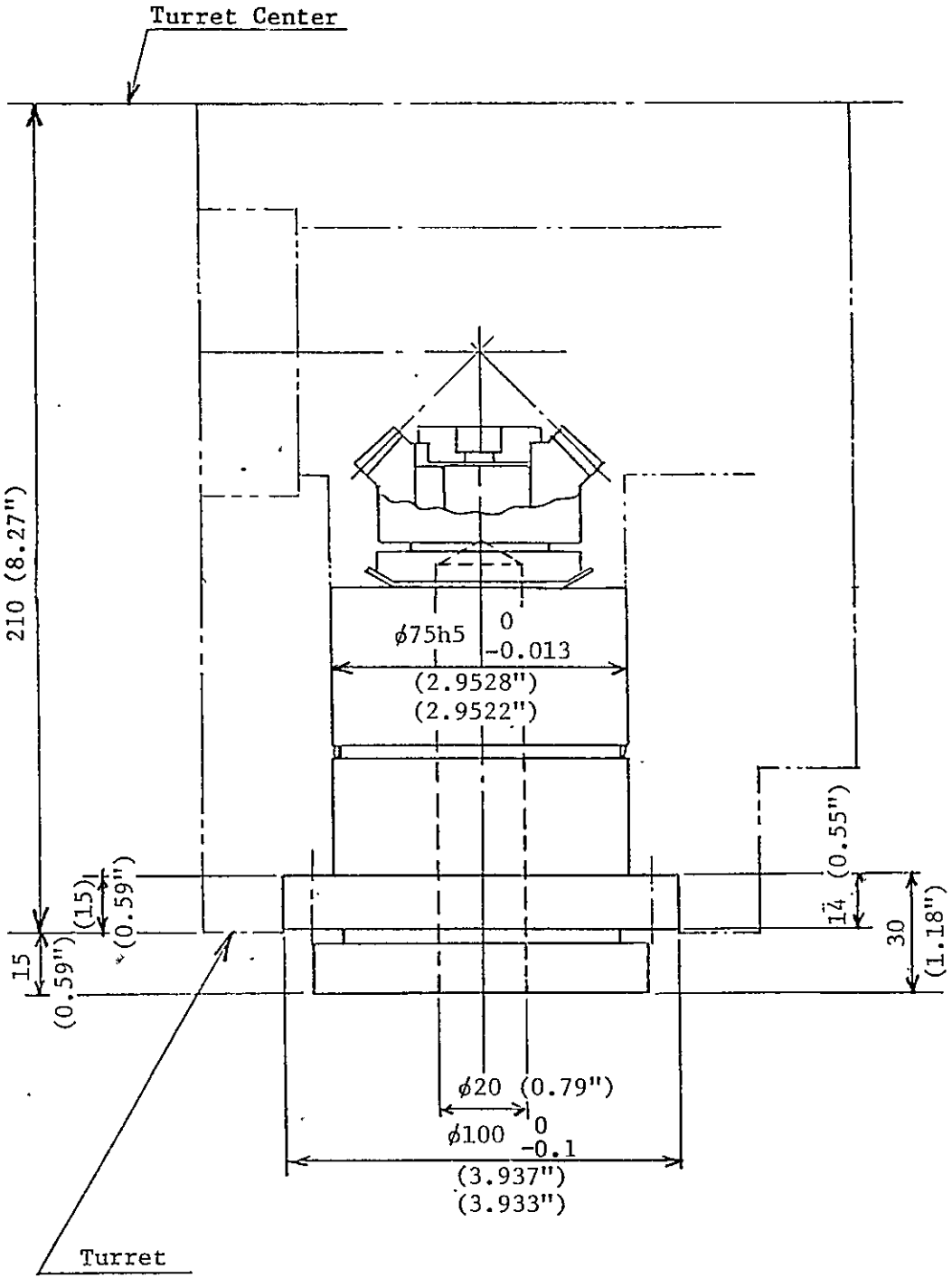
Note) Dimensions in [ ] are for inch boring holder JBH2I.

7-6 Milling tooling system

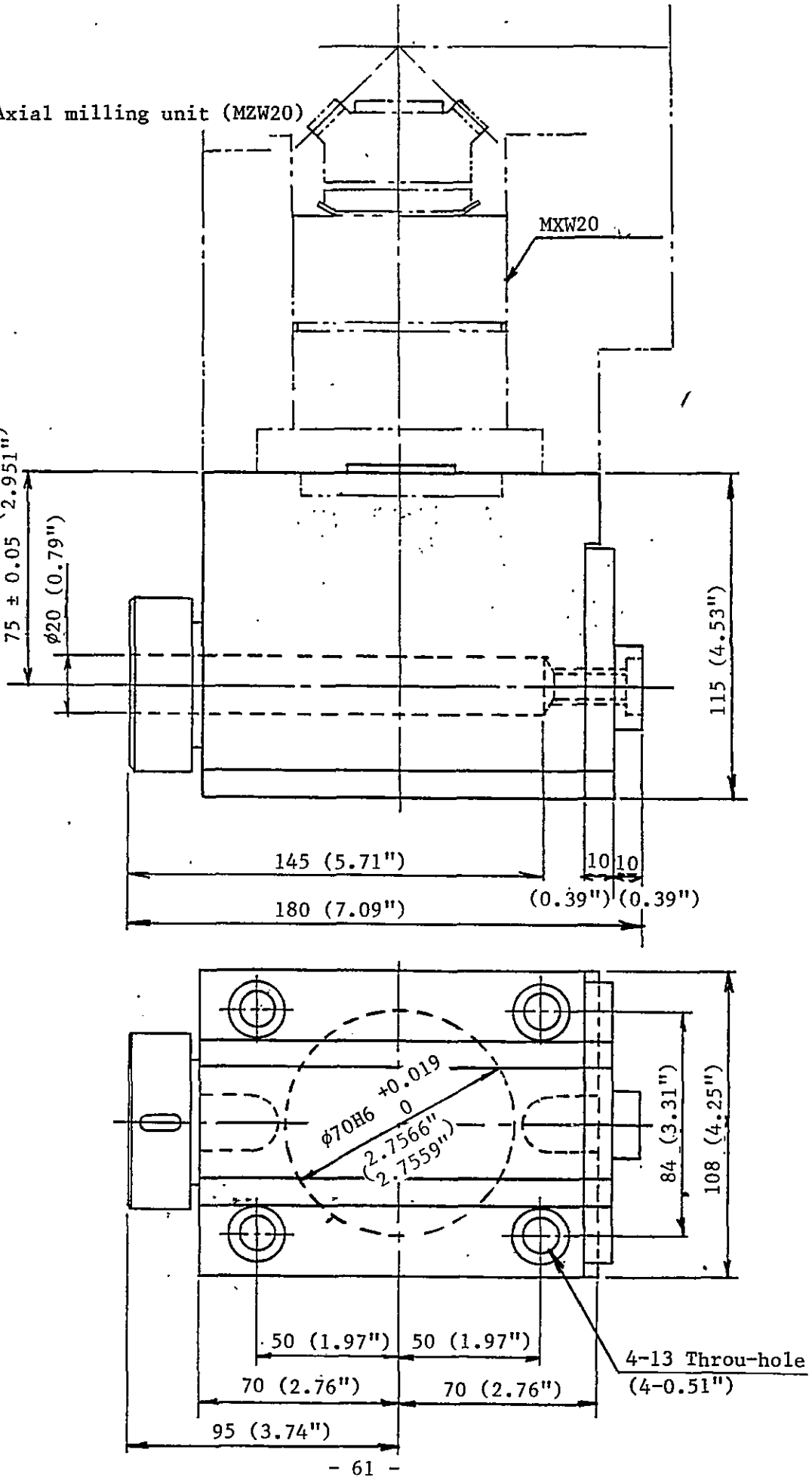


Note) For the quantity, please refer to paragraph 3-2.

7-7 Radial milling unit (MXW20)



7-8 Axial milling unit (MZW20)



8. LUBRICATION

The rotating parts and the sliding surfaces should be constantly lubricated with the correct amounts and the brands of clean lubricants. Supply and/or change the lubricants.
(Refer to Fig. 8-1.)

8-1 Lubrication of headstock

The spindle bearings are sealed with a high quality grease which has been selected after taking account of the bearing life, temperature rise, and others. It is not necessary to lubricate the spindle bearings and do not change grease. If it needs to be changed for a certain reason, contact WASINO.
The life of grease depends on the running conditions and the temperature and is usually between 5,000 hours and 8,000 hours.
Lubrication to other bearings and gears is of forced lubrication by oil pump. Confirmation of lubrication is done by means of oil gauge on the front of headstock. The amount of lubricant is checked by the indication line of oil tank and refill if necessary.
Replace the lubricant and clean the filter in the tank every six months.

8-2 Lubrication of turret

The lubrication of turret drive gear box is of an oil bath.
Pour the oil up to the indication line of oil level gauge.
Replace the oil through the oiling mouth and the drain mouth.

Note) See Fig. 8-1 for the quantity of oil and replacement cycle.

8-3 Lubrication of X axis ball screw

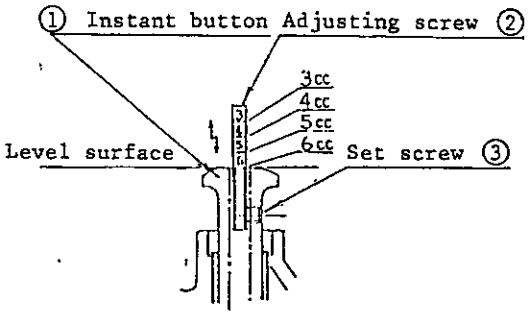
In order to improve the accuracy in the axial direction, the X axis ball screw is immersed into the oil bath. The oil bath should be filled with a sufficient amount of clean oil (4 liters/1 gal.). Replace the oil every month in order to maintain the high accuracy for a long time.

Note) Replace the oil through the oiling mouth and the drain mouth as shown in Fig. 8-2.

8-4 Lubrication of sliding surfaces, X and Z axis gear boxes

The sliding surfaces of the X axis and the Z axis and, the gear boxes are lubricated automatically with a constant amount of lubricant periodically (once every 15 minutes). Supply oil to the oil tank as necessary.

Notes) 1. Automatic lubrication is carried out by the electric pump which is built in the lubrication oil tank. The flow amount of oil by the pump is preset at the shipment to 6 cc (once every 15 minutes).



However, it is recommended to adjust the flow amount to 3 cc (once every 15 minutes) one month later after starting the operation.

The procedure is as follows:

1) Loosen the set screw (3) of the instant button (1).
2) Set the graduation of adjusting screw (2) to "3".
3) Tighten the set screw (3).

2. Clean the filter on the outlet side of lubrication pump every three months.

8-7 Oil filler port

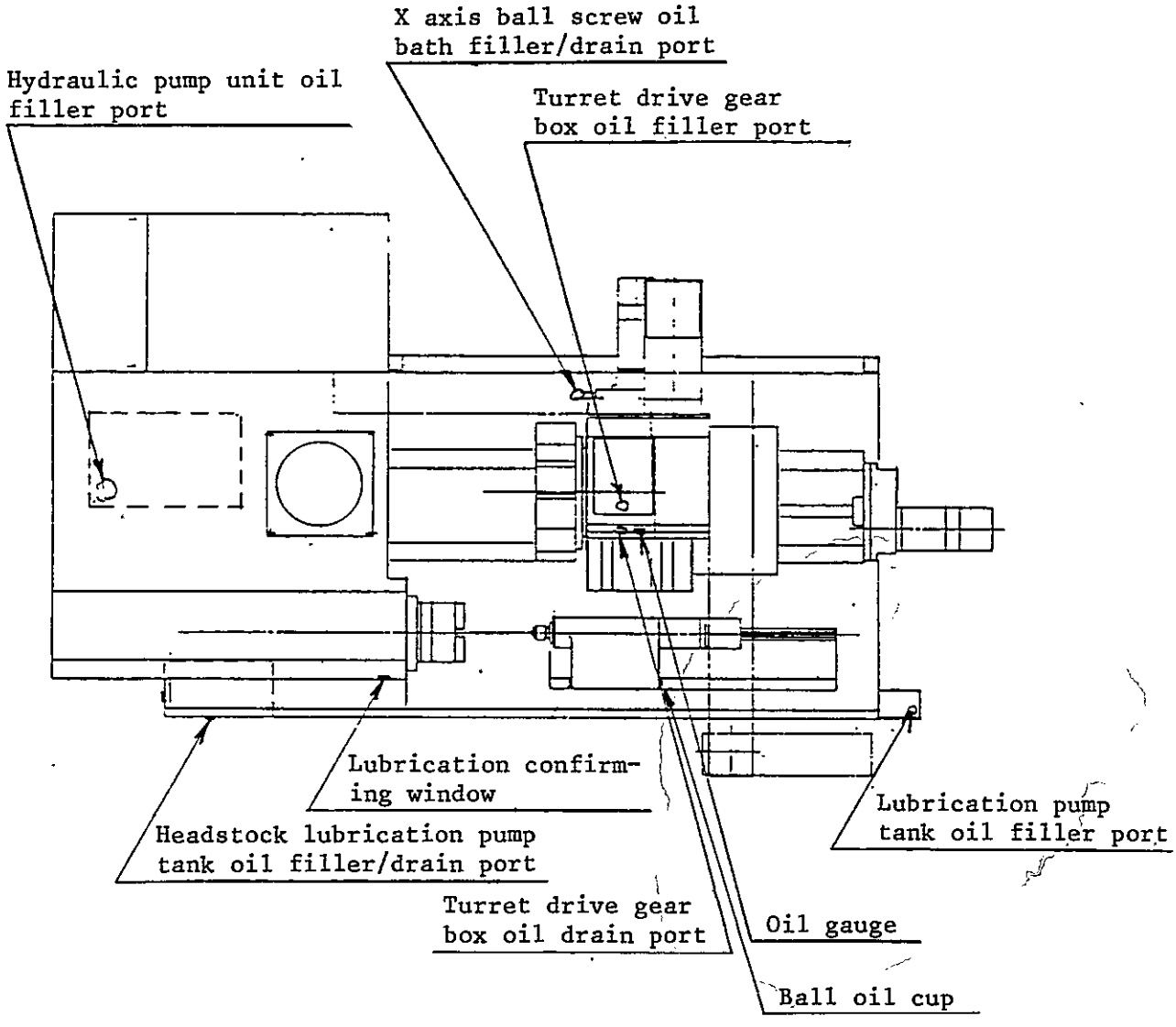

X axis ball screw oil bath filler/drain port
Hydraulic pump unit oil filler port
Turret drive gear box oil filler port
Lubrication confirming window
Lubrication pump tank oil filler port
Headstock lubrication pump tank oil filler/drain port
Turret drive gear box oil drain port
Oil gauge
Ball oil cup

Fig. 8-2 Lubrication port

9. ADJUSTMENT OF EACH SECTION

9-1 Hydraulic pump unit (Standard accessory)

Designation	Specifications
Normal pressure	42 kg/cm^2
Rated pressure	42 kg/cm^2
Flow rate	21/25 liters/min. (50/60Hz)
Capacity of tank	50 liters
Range of pressure adjustment	Chuck pressure: 5 ~ 22 kg/cm^2 Tailstock pressure: 5 ~ 15 kg/cm^2

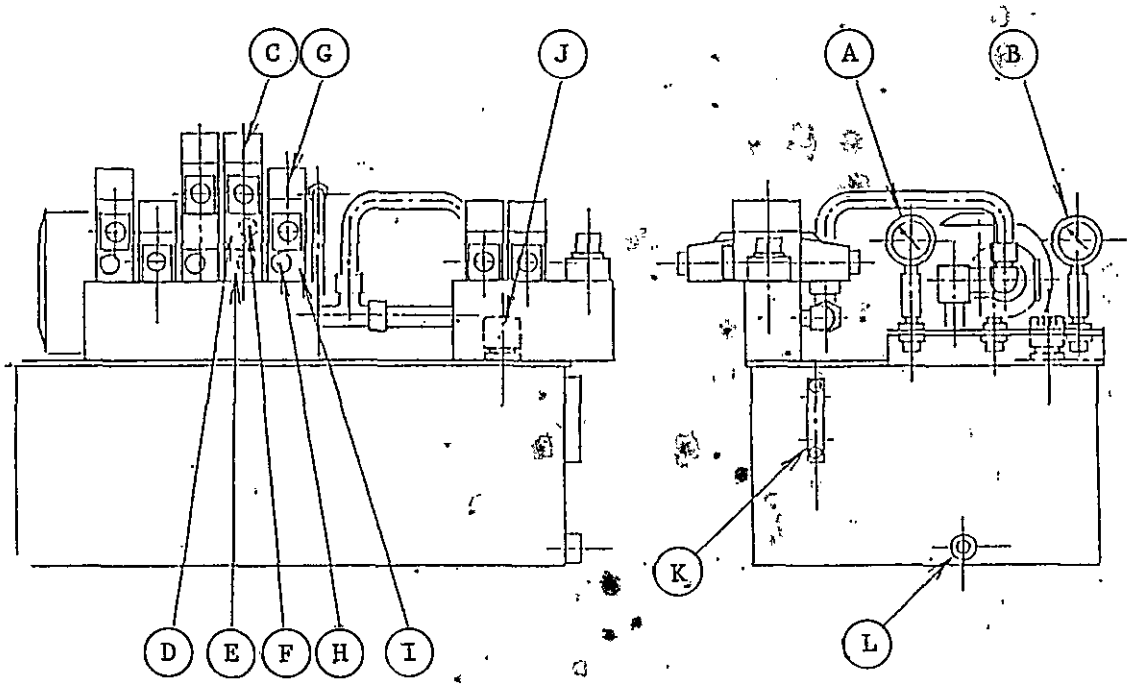
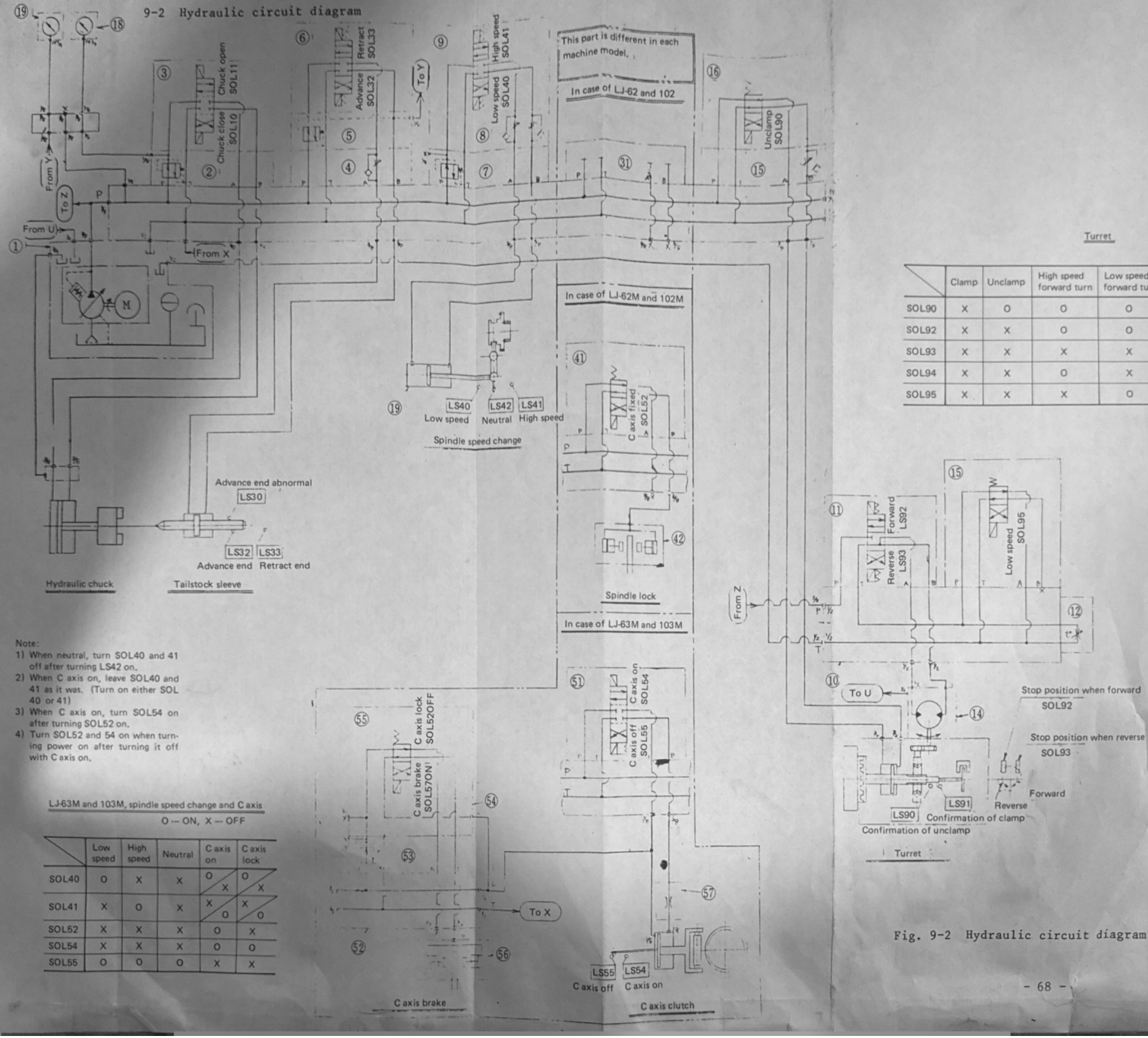


Fig. 9-1 Hydraulic pump unit

Components of hydraulic pump unit

Code	Name
(A)	Pressure gauge for chuck
(B)	Pressure gauge for tailstock
(C)	Solenoid valve for tailstock
(D)	Pressure reduction valve for tailstock
(E)	Flow control valve for tailstock
(F)	Pressure adjust knob for tailstock
(G)	Solenoid valve for clamping/unclamping of chuck
(H)	Pressure adjust knob for chuck
(I)	Pressure reduction valve for chuck
(J)	Oiling mouth for hydraulic tank
(K)	Oil gauge
(L)	Drain mouth

9-2 Hydraulic circuit diagram



Note:
1) When neutral, turn SOL40 and 41 off after turning LS42 on.
2) When C axis on, leave SOL40 and 41 as it was. (Turn on either SOL 40 or 41)
3) When C axis on, turn SOL54 on after turning SOL52 on.
4) Turn SOL52 and 54 on when turning power on after turning it off with C axis on.

LJ-63M and 103M, spindle speed change and C axis

O — ON, X — OFF

	Low speed	High speed	Neutral	C axis on	C axis lock
SOL40	O	X	X	O / X	O / X
SOL41	X	O	X	X / O	X / O
SOL52	X	X	X	O	X
SOL54	X	X	X	O	O
SOL55	O	O	O	X	X

Turret

O — ON, X — OFF

	Clamp	Unclamp	High speed forward turn	Low speed forward turn	High speed reverse turn	Low speed reverse turn
SOL90	X	O	O	O	O	O
SOL92	X	X	O	O	X	X
SOL93	X	X	X	X	O	O
SOL94	X	X	O	X	O	X
SOL95	X	X	X	O	X	O

Fig. 9-2 Hydraulic circuit diagram

No.	Designation	Type	Maker	Remarks
1	Hydraulic pump unit		DAIKIN	
2	P-port reduction valve	MG-02P-03-10	DAIKIN	Attachment to pump unit
3	Solenoid valve	JSO-G02-2NA -10-N	DAIKIN	Attachment to pump unit, AC 100V
4	A-port throttle valve	MT-02A-10	DAIKIN	
5	B-port reduction valve	MG-02B-03-10	DAIKIN	
6	Solenoid valve	JSO-G02-2CA -10-N	DAIKIN	AC 100V
7	P-port reduction valve	MG-02P-03-10	DAIKIN	Attachment to pump unit
8	A- and B-port throttle valve	MT-02W-10	DAIKIN	Attachment to pump unit
9	Solenoid valve	JSO-G02-2CA -10-N	DAIKIN	Attachment to pump unit
10	Subplate			Attachment to pump unit
11	Solenoid valve	JSO-G02-2CA -10-N	DAIKIN	Attachment to pump unit
12	B-port throttle valve (with temperature compensation)			Attachment to pump unit
13	Solenoid valve	JSO-G02-2BA -10-N	DAIKIN	Attachment to pump unit
14	Hydraulic motor	H-050-DA2	SUMITOMO EATON	
15	B-port throttle valve	MT-02B-10	DAIKIN	Attachment to pump unit
16	Solenoid valve	JSO-G02-2BA -10-N	DAIKIN	Attachment to pump unit
17	Pressure gauge for chuck		NAGANO KEIKI	50 kg/cm^2

No.	Designation	Type	Maker	Remarks
18	Pressure gauge for tailstock		NAGANO KEIKI	50 kg/cm^2
19	Cylinder			
31	Blocking block	BS-02-10	DAIKIN	Attachment to hydraulic unit, only for LJ-62, 102
41	Solenoid valve	JSO-G02-2BA -10-N	DAIKIN	AC 100V, only for LJ-62M, 102M
42	Disk brake		TACHIBANA	Only for LJ-62M, 102M
51	Solenoid valve	JSO-G02-2NA -10-D-N	DAIKIN	AC 100V, only for LJ-63M, 103M
52	Mani-block	BT-102-10	DAIKIN	Only for LJ-63M, 103M
53	P-port low pressure reduction valve	MGB-02P-03-10	DAIKIN	Only for LJ-63M, 103M
54	Block		WASINO	Additional machining to BG-02PT-10, only for LJ-63M, 103M
55	Solenoid valve	JSO-G02-2BA -20-N	DAIKIN	AC 100V, only for LJ-63M, 103M
56	Disk brake		TACHIBANA	Only for LJ-63M, 103M
57	Fixed throttle valve		WASINO	Cylinder built-in type, only for LJ-63M, 103M

9-3 Hydraulic chuck

9-3-1 Structure of hydraulic chuck

The hydraulic chuck is clamped and unclamped by the foot pedal. There are various types of hydraulic chucks, but here the adjusting method for the standard hydraulic chuck will be explained.

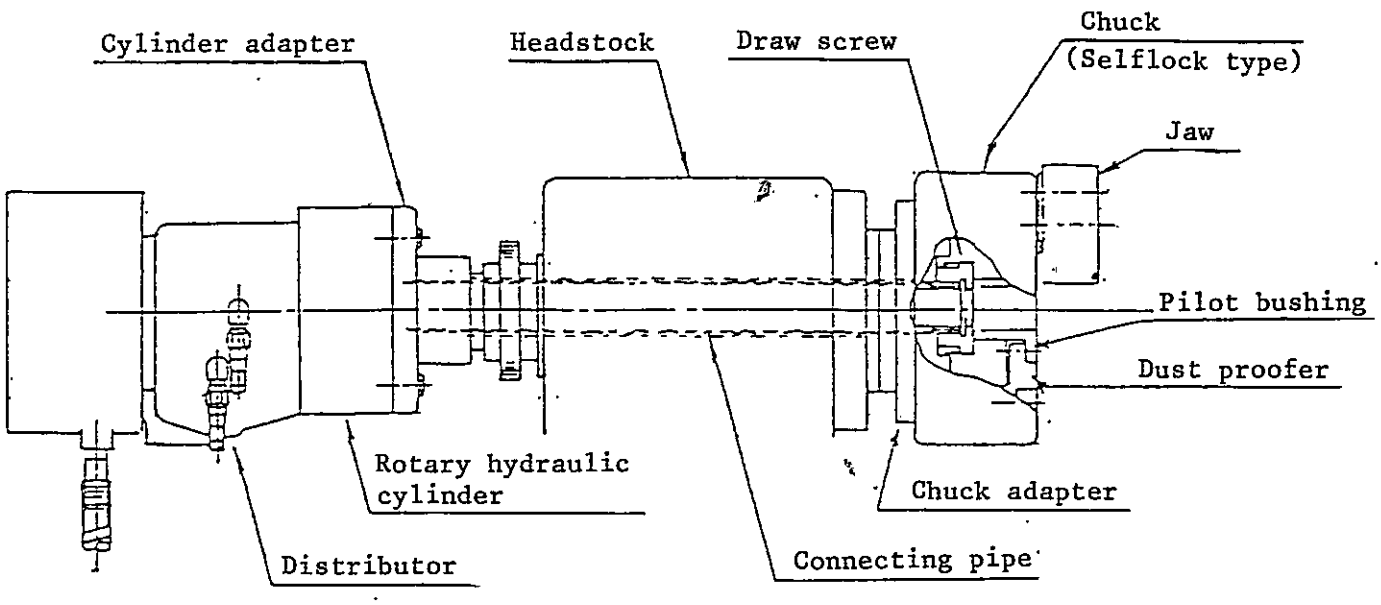


Fig. 9-3 Hydraulic chuck

9-3-2 Adjustment of the jaw opening

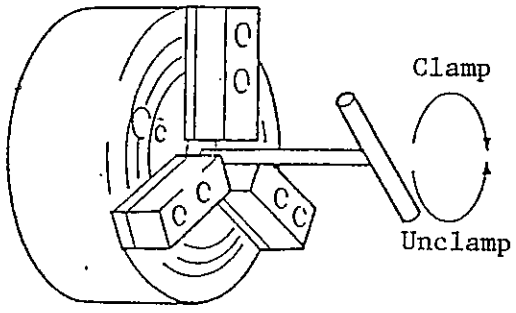


Fig. 9-4

Depress the foot pedal, and adjust the draw screw with a special tool (accessory) to obtain the desired jaw operating range. For a large jaw movement which can not be adjusted by the above method, change the serration engagement between jaw and master jaw. In this case, all three jaws must be slided by the same amount.

9-3-3 Specifications of hyd. chuck

Two kinds of chucks are available to meet various chucking needs: Through hole hyd. chuck No.8, and through hole hyd. chuck No.10.

	Type	Specification	Jaw	Remarks
Through hole hyd. chuck No.8	Chuck B-08A Cylinder F1546H	Max. 4000 rpm Thru hole: ø45mm Chucking force: Max. 7800 kg Operating pressure: 22 kg/cm^2	Soft & hard jaws	Standard for countries except U.S.A.
Through hole hyd. chuck No.10	Chuck B-10A Cylinder F1768H	Max. 3500 rpm Thru hole: ø64mm Chucking force: Max. 9900 kg Operating pressure: 22 kg/cm^2	Soft & hard jaws	Standard for U.S.A.

Note) Please consult for other types of chucks.

Notes) 1. Make sure that the oil pressure for chuck is correct.

2. Never knock the chuck body at any case.

3. Clean the sliding surface of chuck by removing the master jaw, and supply oil at least every three months.

4. Chuck and cylinder must be disassembled at least every six months to clean and replace the worn parts if any. As for disassemble, first remove the draw screw and connecting rod and then take out the hydraulic cylinder from spindle.

5. When removing the standard hydraulic chuck and mounting the other chuck to the spindle, be sure to remove the cylinder as well.

6. For details, see instruction manual issued by the chuck manufacturer.

9-3-4 Replacement of jaw

For jaw replacement, clean the serration parts of master jaws and jaws and the jaw nut fitting part carefully, and then install with the same serration engagement as at the time of jaw forming. To get high accuracy chucking, self turn the jaws according to the diameter of raw material.

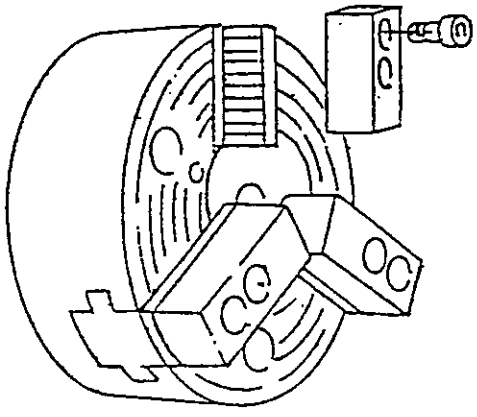


Fig. 9-5

9-3-5 Adjustment of the chucking force

This is done with the pressure reduction value of the hydraulic pump unit. (See Fig. 9-1.) Adjust it while observing the pressure gauge. After adjustment, lock it with the lock nut. The chuck pressure adjusting range is from 5 to 22 kg/cm^2.

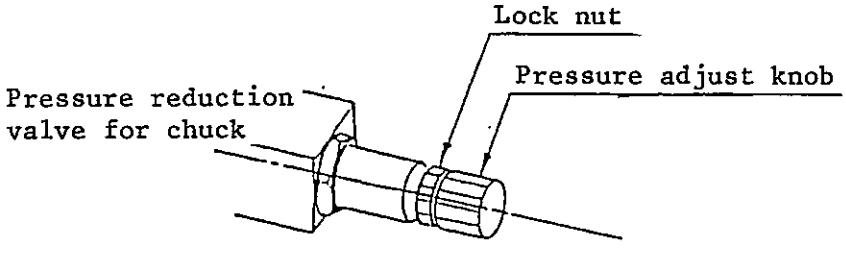
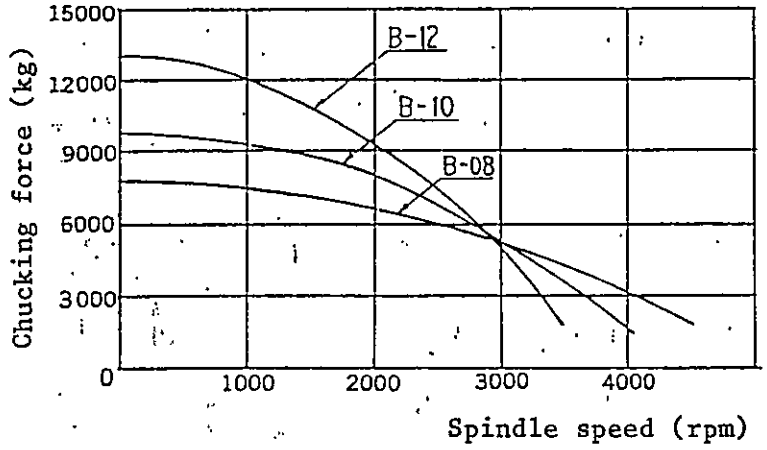


Fig. 9-6

9-3-6 Spindle speed and chucking force

Chucking force characteristic curve (reference)



1) Chuck maximum operating speed

The chucking force of the chuck may be decreased as a result of centrifugal force reacting in proportion to the spindle speed in case of O.D. chucking. However in general, it is so defined that the maximum speed at which the dynamic chucking force attains becomes a half of the static chucking force when the standard jaw is used under ordinary operating condition and chucked with an allowable cylinder.

2) Spindle speed and chucking force

The decreasing ratio of chucking force against optional speed is shown above. The top jaw is a standard jaw and functioning at the maximum operating thrust. This value is, however, the ordinary case and care must be taken because it greatly varies depending on the adjusting position of the top jaw, size of jaw and cutting conditions.

9-3-7 Changeover of inner/outer clamping (by parameter)

Setting method

1) Set the mode select switch (8) to "MDI" position.

2) Depress the "NC/PC" key.

3) Depress the soft keys "PCPRM" and, by depressing the soft key "COUNTER", set the cursor to the "PRESET" position of the COUNTER No.20.

No.	ADDRESS	PRESET	CURRENT
20	C76		0

4) Depress the data key "1" (inner clamping) or "0" (outer clamping).

5) Depress the "INPUT" key. Then, the new data are stored and displayed as follows:

No.	ADDRESS	PRESET	CURRENT
20	C76	0 or 1	0

0 : Outer clamping
1 : Inner clamping

Caution) Never attempt to perform this changeover operation while the spindle is running.

9-3-8 Procedure of forming raw jaws (for O.D. chucking)

1) Attach the raw jaws on the chuck.

2) Set the chuck to inner clamping by parameter setting. (See 9-3-7.)

3) Cut manually the I.D. of jaw to (d) about 8 mm (0.3") smaller than the workpiece chucking diameter (D).

4) Change inner clamping by outer one.

5) Clamp a plug (outer diameter d-1 mm (d-0.04") length about 6 mm (0.24") with the bore (d) of jaws.

6) Cut manually the raw jaws to the chucking diameter (D) of workpiece and remove the plug after forming.

7) Remove burrs.

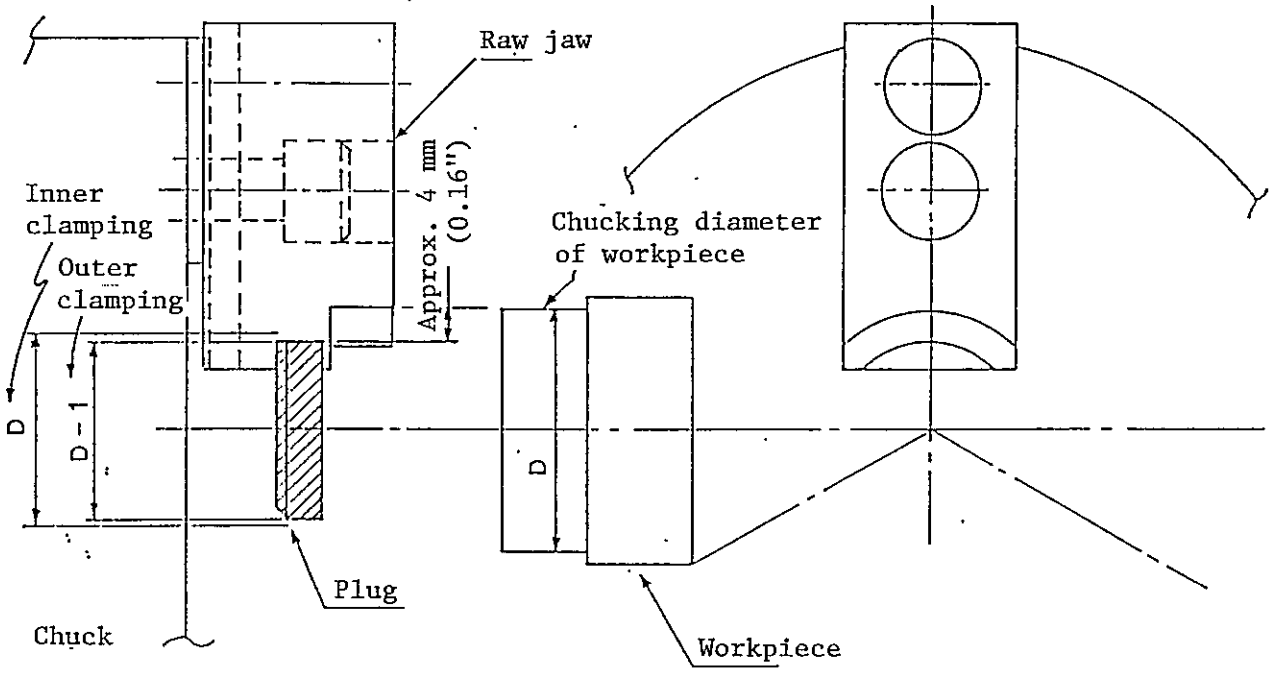


Fig. 9-7

9-3-9 Thru-hole hydraulic chuck No.8

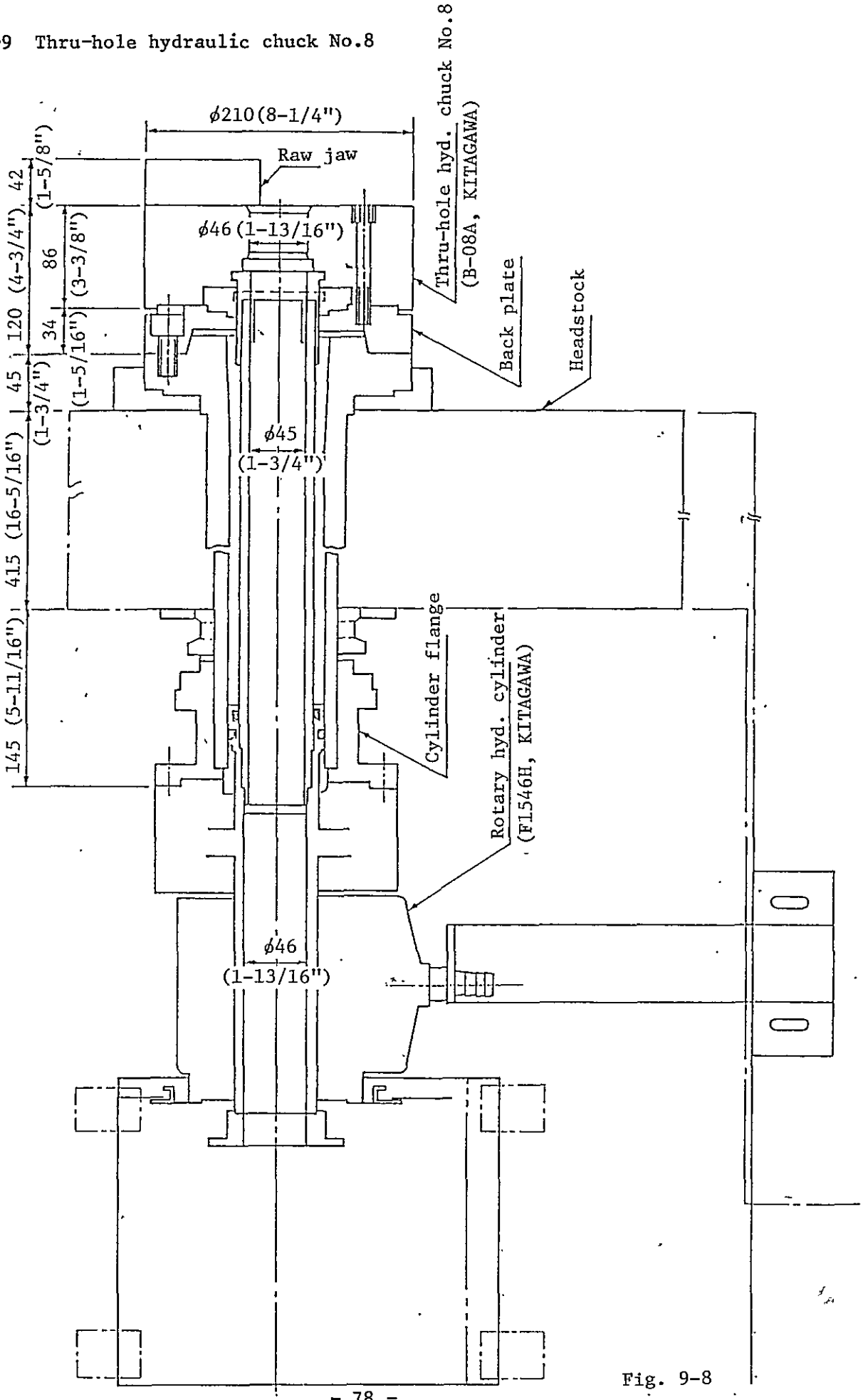


Fig. 9-8

9-3-10 Thru-hole hydraulic chuck No.10

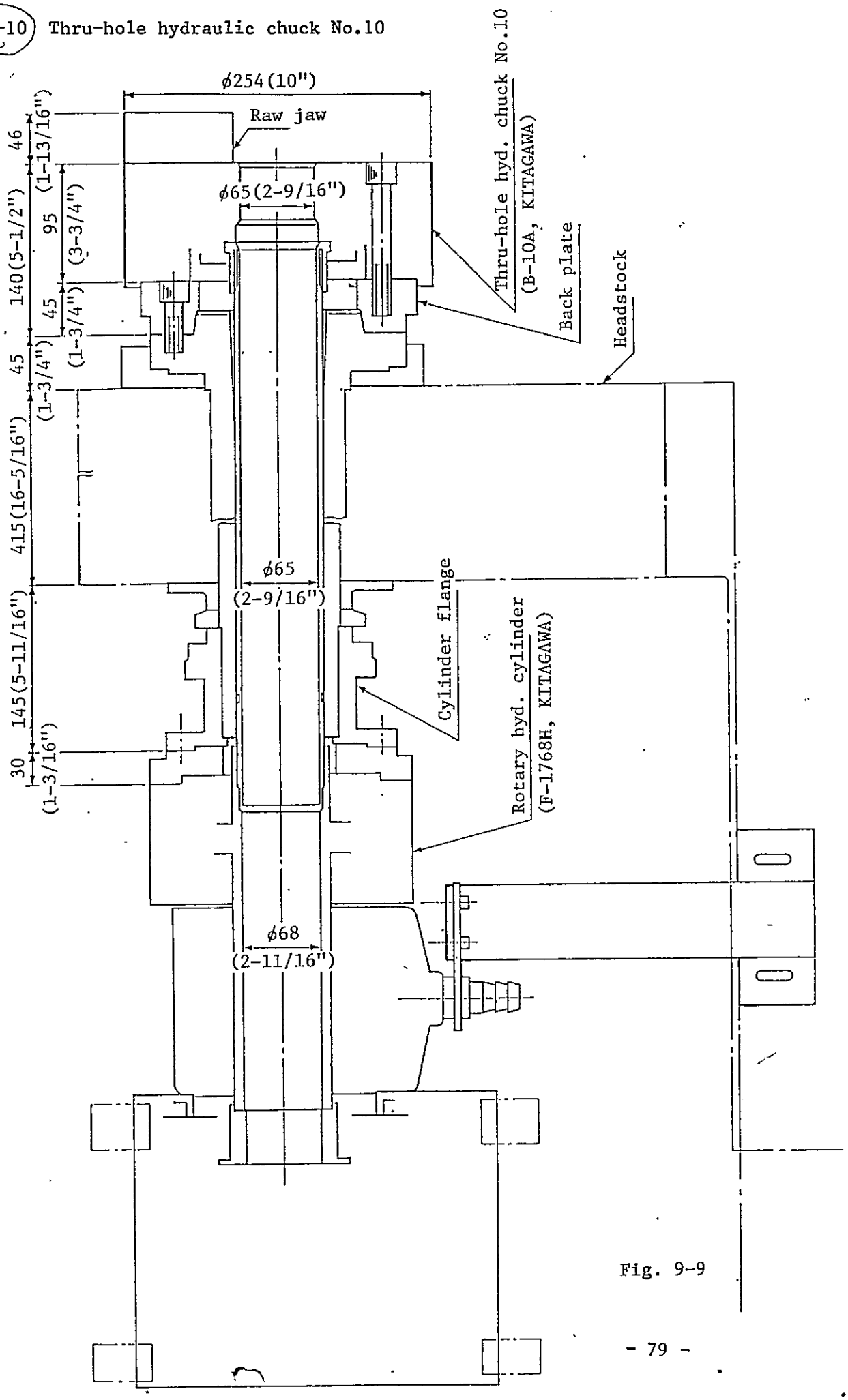


Fig. 9-9

9-4 Hydraulic tailstock

The tailstock is monoblock with top and bottom sturdy construction and can be fixed at the right or left arbitrary position on the exclusive flat and most guide ways.

9-4-1 Operation method

The sleeve of the hydraulic tailstock can be advanced, retracted and stopped (effective only at retraction) by the tailstock sleeve switch (20) for manual operation. It can also be advanced and retracted by M function in case of automatic operation.

M function	Movement of tailstock sleeve
M32	Advance
M33	Retract

Note) Refer to the paragraph 5-3-21 for the details on manual operation.

9-4-2 Centering of tailstock

If the center line of the tailstock sleeve does not align with that of the main spindle in the horizontal plane, adjust the center of the tailstock sleeve by the centering screws located at opposite positions on the front and rear of the tailstock.

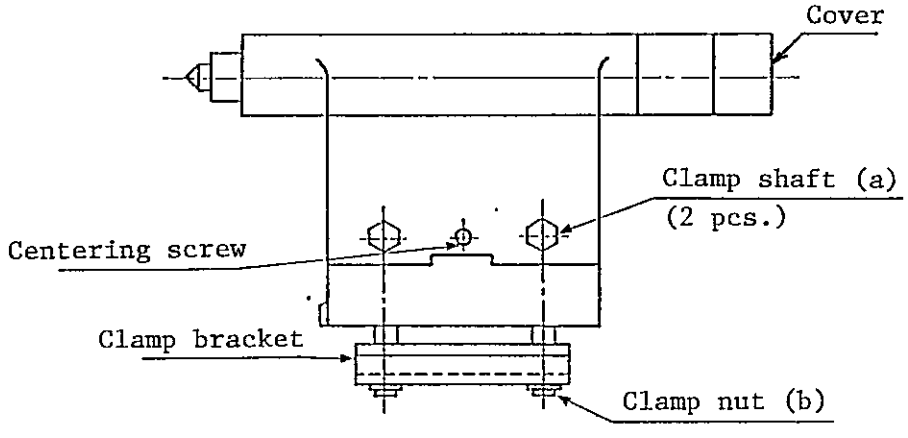


Fig. 9-10

9-4-3 Adjustment of clamping force of tailstock

The tailstock is clamped by the clamp shaft (a) shown in Fig. 9-10. Clamping is done by pulling up the clamp bracket by means of the eccentricity of the shaft.
When the clamping force has to be adjusted due to elongation of the bolts, or loosening of the nuts, move the tailstock to the right end of the bed and adjust the clamping force by turning the nut (b). The clamp nut (b) is a self-locking nut and requires no double nuts. The clamping force increases as the clamp shaft is brought near the top of the eccentricity. When clamping, adjust the clamp nut with the double-ended ring spanner so that the punch mark on the clamp shaft is in the top position.

9-4-4 Adjustment of tailstock sleeve

The stroke of the tailstock sleeve is 100 mm (4 in.) which is constant. Consequently, move the tailstock body according to the workpiece, if necessary.

9-4-5 Adjustment of sleeve advance speed

Adjustment of tailstock sleeve advance speed can be made by the flow control valve located on the hydraulic pump unit. (See Fig. 9-1.)
Turn the adjusting knob counter-clockwise to increase the speed and turn it clockwise to decrease the speed.
After adjustment, lock the knob with lock nut.

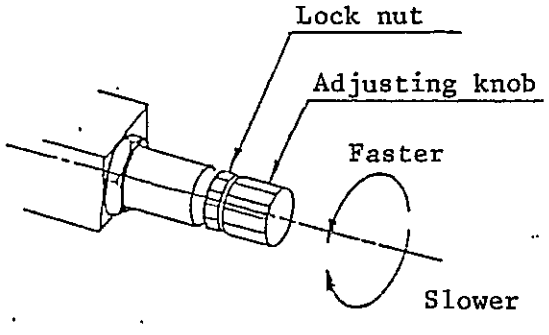


Fig. 9-11 Flow control valve for tailstock

9-4-6 Adjustment of sleeve thrust

The adjustment of the tailstock sleeve thrust is done by the pressure reduction valve of the hydraulic pump unit.
(See Fig. 9-1.)
Adjust the pressure in the range of 5 ~ 15 kg/cm^2 by turning the adjusting knob and by seeing the pressure gauge.

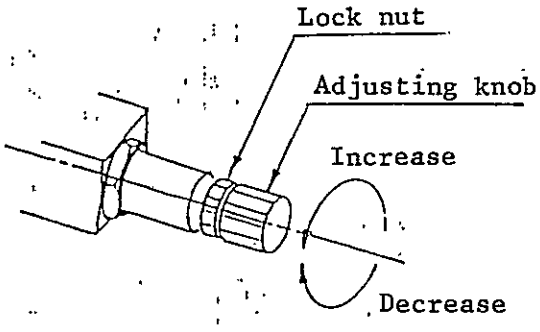


Fig. 9-12 Pressure reduction valve for tailstock

9-4-7 Adjustment of limit switch

Advance the tailstock sleeve. Then, adjust the clearance between the piston rod and the limit switch to 3 ~ 8 mm (0.1 ~ 0.3 in.) with the limit switch for forward end.
For this, the adjustment is done by loosening the attaching bolt and sliding the limit switch.

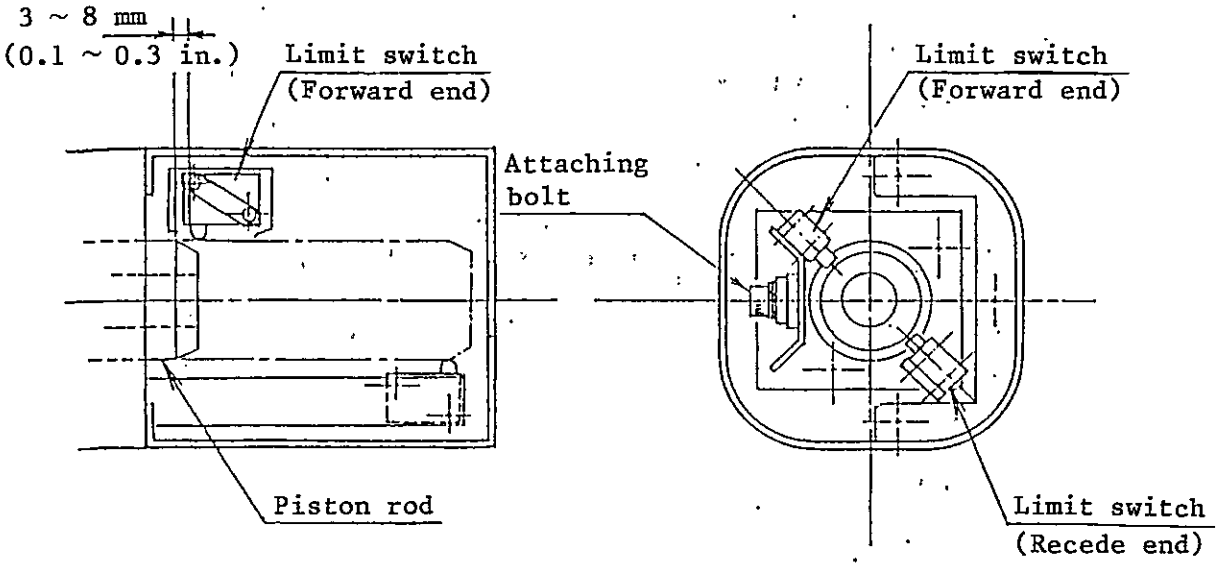


Fig. 9-13 Limit switch of tailstock

Note) Before using the tailstock, it should be adjusted the limit switch for forward end as described above.
Otherwise, the following troubles may happen:

When depressing the RESET or Emergency stop button after the tailstock sleeve forward command, the sleeve movement stops but it does not push securely the workpiece. In this case, it is necessary to command the sleeve advance once again before the next operation.

Caution) On the machine for European countries, a pressure switch is provided for confirmation of hydraulic actuation. (Actuating pressure: 15kg/cm^2, Duration of pressure drop for actuation: 2.5 sec.).
If hydraulic equipments such as turret, chuck, tailstock, etc., are operated simultaneously on those machines, emergency stop is caused by the actuation of pressure switch.
Therefore, avoid such simultaneous operation and program of such movement.

9-5 Coolant equipment (Standard accessory)

This equipment is used to improve the cutting efficiency removing the chips and heat generated during operation.
The device is attached to the oil pan and installed separately from the machine. The coolant pump supplies the coolant in the oil pan (a combined tank of chip and coolant) through hoses and cocks to the coolant nozzles. (Refer to Fig. 9-14.)

Note) Before using the coolant equipment, be sure to check the priming in the coolant pump.

9-5-1 Capacity

Coolant tank capacity:	110 liters (29 gal.)
Coolant pump - Lift:	60 liters/min. (16 gal./min.)
- Total head:	4 m (157 in.)
	(0 ~ 40°C, fresh water, 60Hz)

9-5-2 Operation

Refer to the paragraph 5-3-20, Coolant switch (19).

9-5-3 Adjustment of flow rate

The amount of coolant at the main nozzle is adjusted with the cock. (Refer to Fig. 9-14.)
The coolant nozzle of turret is automatically selected with turret indexing and the coolant is supplied from the indexed station. The amount is automatically set with the feed nozzle of tool holder.

9-5-4 Coolant in use

Water-insoluble coolant which does not corrode metals is recommended.
When water-soluble coolant is used, pay attention to the following:

1. Use an emulsion type coolant.
2. Do not use compressed air to remove chips and dust as the coolant may penetrate into the machine sections.
3. Do not apply an excessive amount of coolant.

Notes)
1. When the discharge amount of coolant is dropped from the normal operating condition, refill accordingly.
2. Replace the coolant and clean the tank, every 3 months though its cycle varies according to the coolant used.

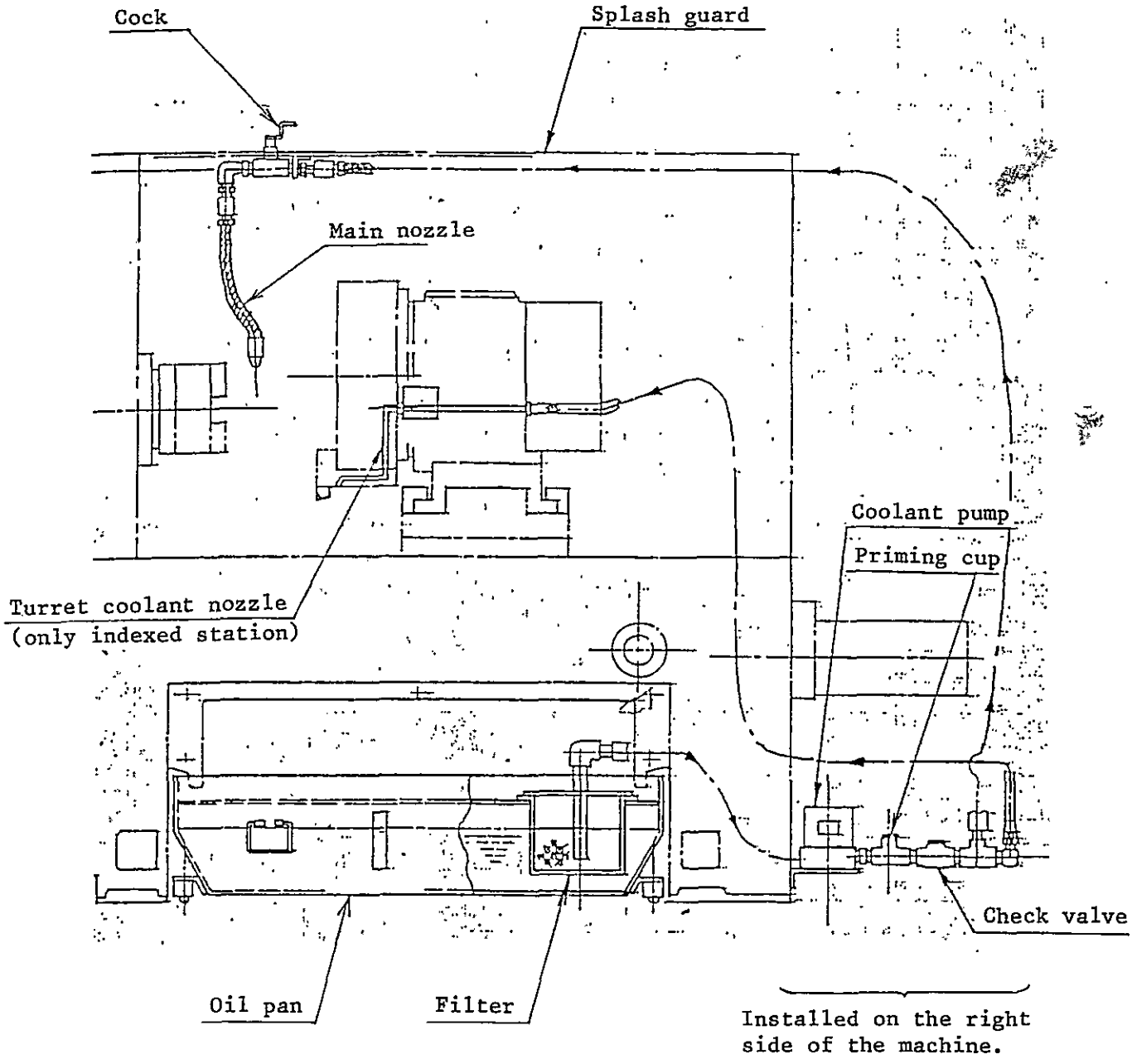


Fig. 9-14 Coolant circuit

9-6 Adjustment of spindle drive belt tension

Special high torque transmitting V-belts are used for the spindle drive belts. If the tension of the V-belt is too high, the resistance is increased and an excessive force is applied on the bearing. In this case, an excessive heat is generated and the service life of belt is shortened. Moreover, the accuracy of the machine is affected. If it is too slack, it may produce slipping and the required torque can not be transmitted. Consequently, it is important to adjust the belt tension correctly.

9-6-1 Method of adjustment (Refer to Fig. 9-15.)

The tension of the V-belt can be adjusted by moving the motor base up and down after loosening the lock nuts (a) and (b).

Type of belt: Power Ace (Bando Chemical)
3V-630 x 7 belts

Tension: F; 2.3 kg/5 lbs. (2.7 kg/6.4 lbs.)
Bent S; 9.4 mm/0.37 in. ..... per belt

The above belt tension is for readjustment. The tension in ( ) is for new belt.

Notes) 1. Make sure to lock the nuts (a) and (b) after adjustment.

2. Use a tension meter to check the belt tension, and adjust it to the above conditions.

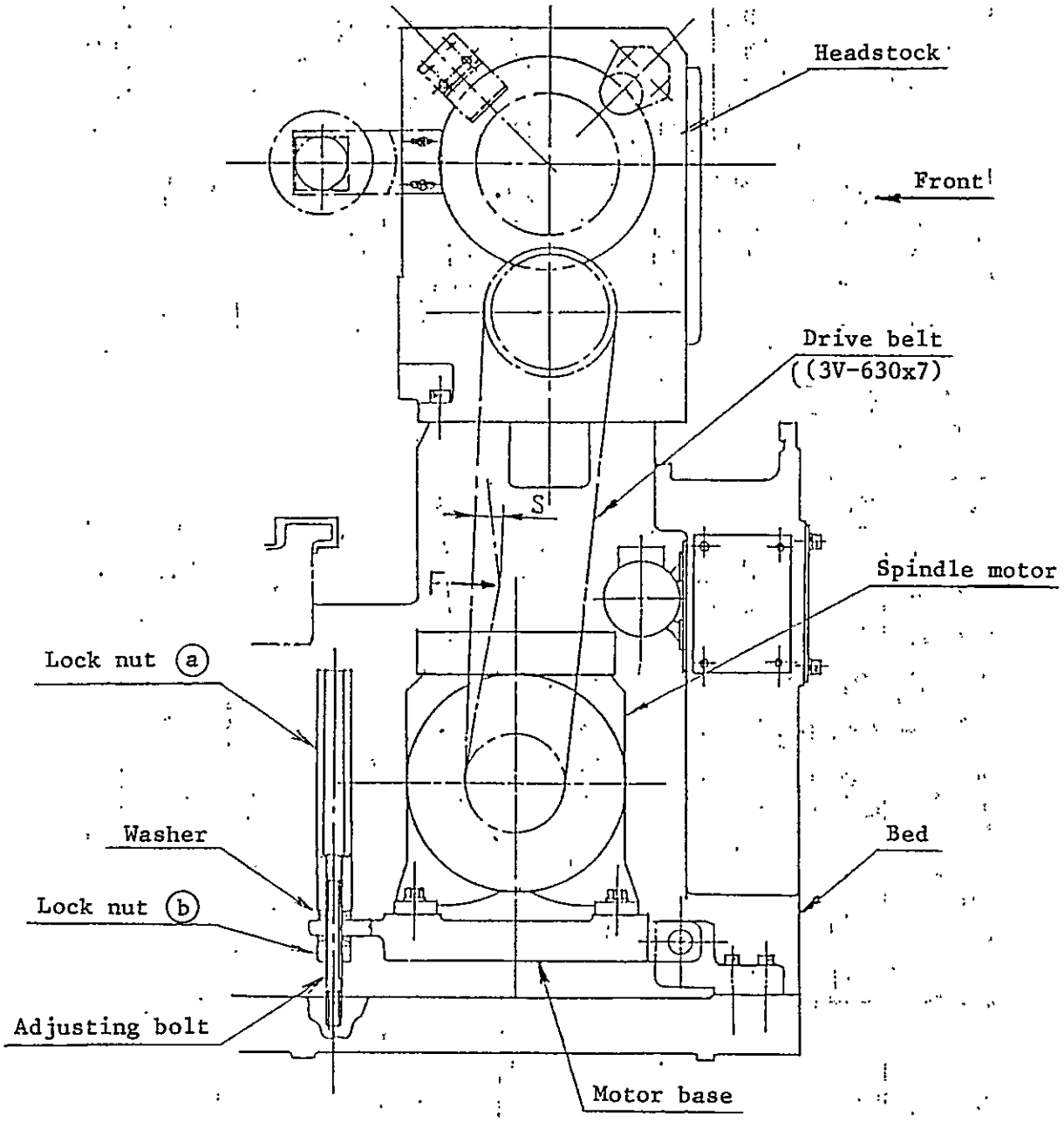


Fig. 9-15 Adjustment of belt tension

9-7 Troubleshooting by condition message lamps

The machine is provided with condition message lamps to indicate the status of the machine. The cause of lighting of each lamp can be found by the diagnosis function of PC.
(Refer to the paragraph 5-3-26.)

9-7-1 Status for starting the cycle operation

The automatic operation can be started when the condition message lamps are as follows:

Condition message lamp	ON/OFF	Machine status
START CONDITION	ON	Ready to start
ERROR	OFF	
EMERGENCY STOP	OFF	

Note) The machine can not be started if the illumination of lamps is different from the above. Find out the cause and remove it by the following way.

9-7-2 Case of START CONDITION lamp OFF

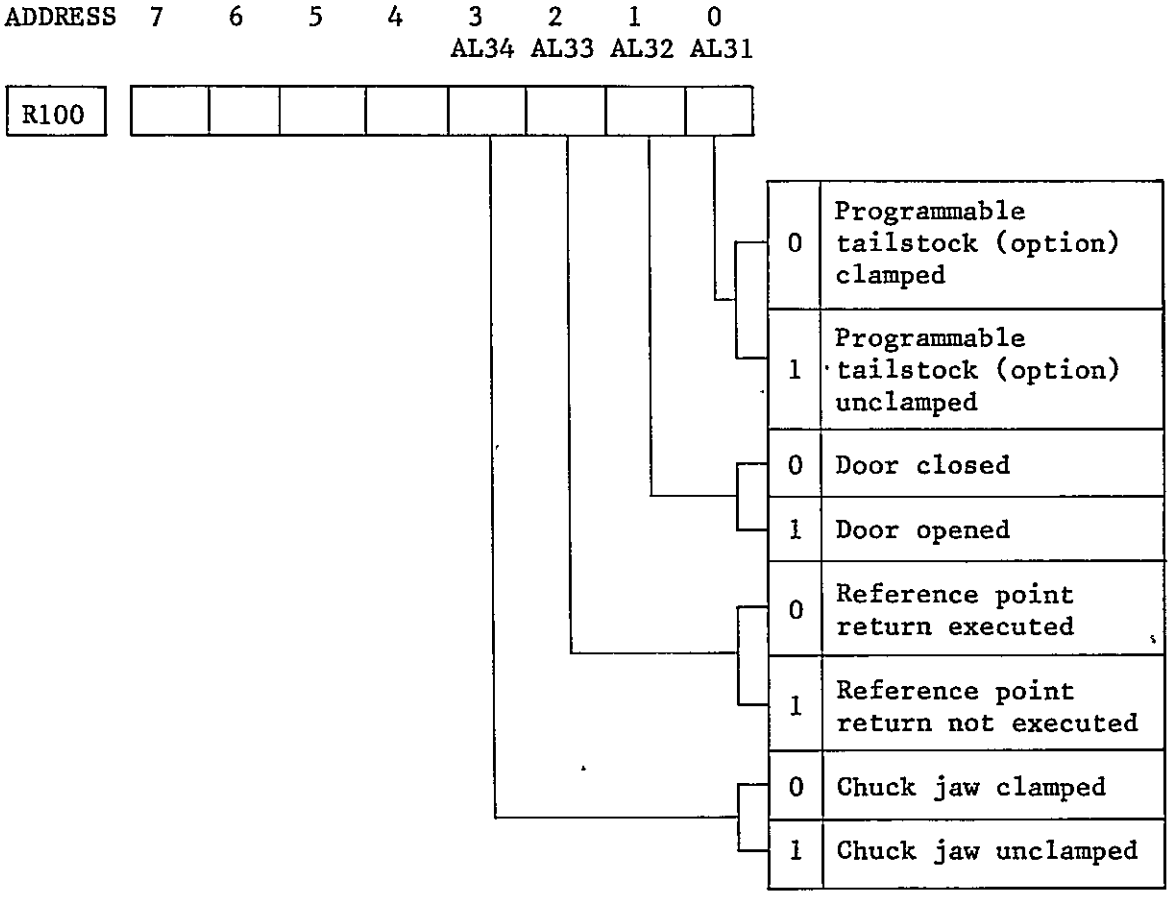
The cause can be seen at the address [R100] of [PCDGN].

Operation

1) Depress the key "NC/PC".

2) Depress the soft key "PCDGN".

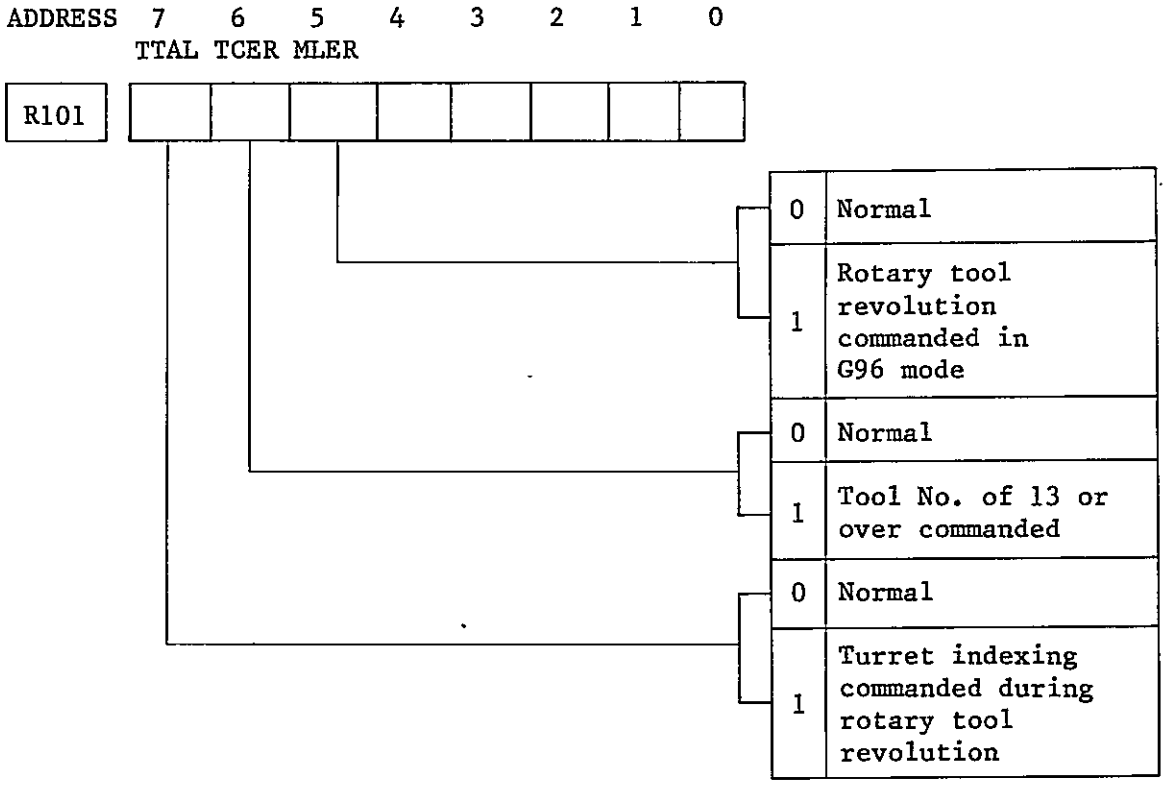
3) Display the address No. "R100" by depressing the keys, [SHIFT], [GR], [1] [0] [0] and [SEARCH] in this order.

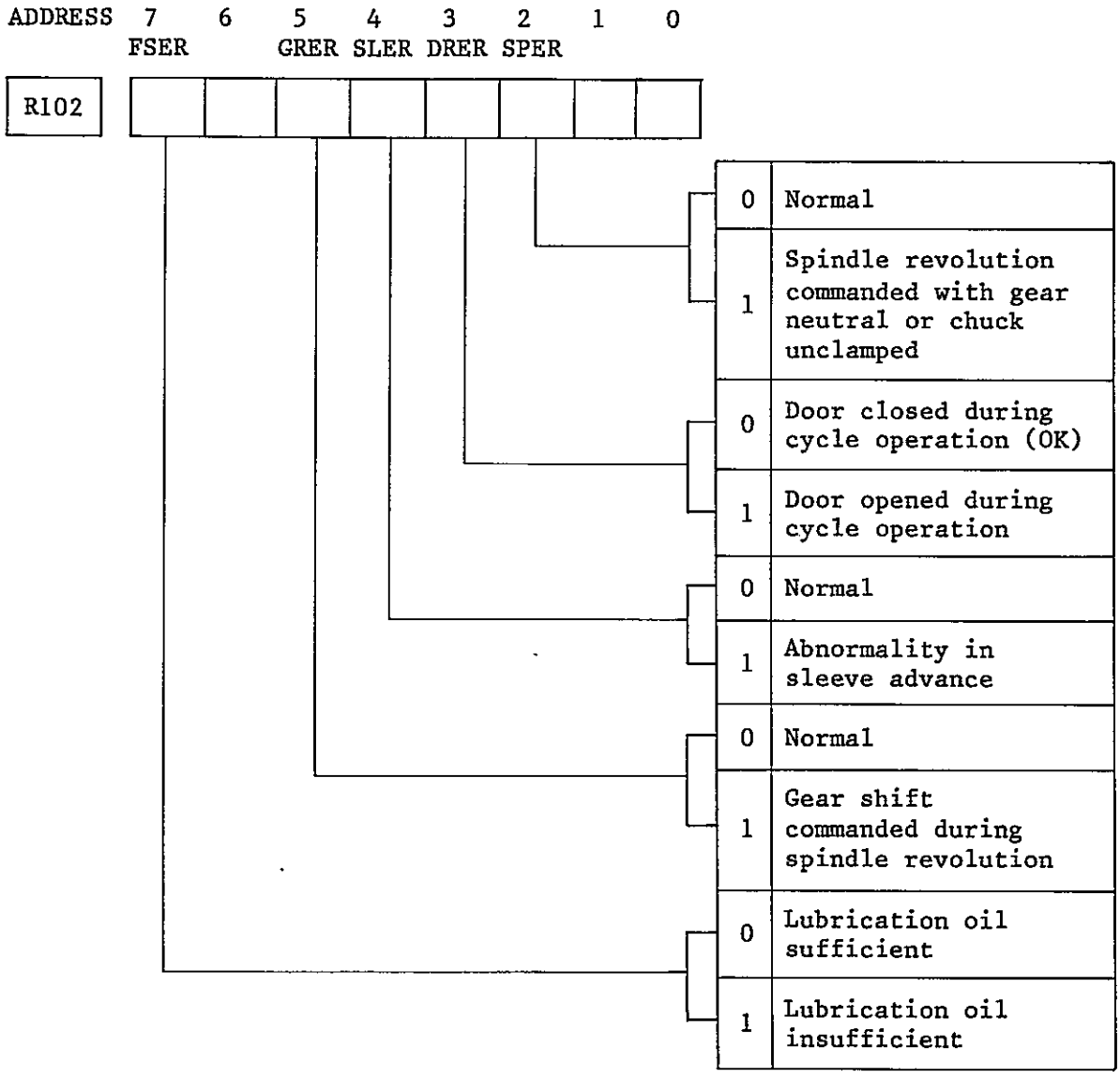

ADDRESS 7 6 5 4 3 2 1 0
AL34 AL33 AL32 AL31
R100
0 Programmable tailstock (option) clamped
1 Programmable tailstock (option) unclamped
0 Door closed
1 Door opened
0 Reference point return executed
1 Reference point return not executed
0 Chuck jaw clamped
1 Chuck jaw unclamped

9-7-3 Case of ERROR lamp ON

The cause can be found at the addresses R101 and R102 of PCDGN.

The operation is similar to those described in 9-7-2.


ADDRESS 7 6 5 4 3 2 1 0
TTAL TCER MLER
R101
0 Normal
1 Rotary tool revolution commanded in G96 mode
0 Normal
1 Tool No. of 13 or over commanded
0 Normal
1 Turret indexing commanded during rotary tool revolution


ADDRESS 7 6 5 4 3 2 1 0
FSER GRER SLER DRER SPER
R102
0 Normal
1 Spindle revolution commanded with gear neutral or chuck unclamped
0 Door closed during cycle operation (OK)
1 Door opened during cycle operation
0 Normal
1 Abnormality in sleeve advance
0 Normal
1 Gear shift commanded during spindle revolution
0 Lubrication oil sufficient
1 Lubrication oil insufficient

9-7-4 Case of EMERGENCY STOP lamp ON

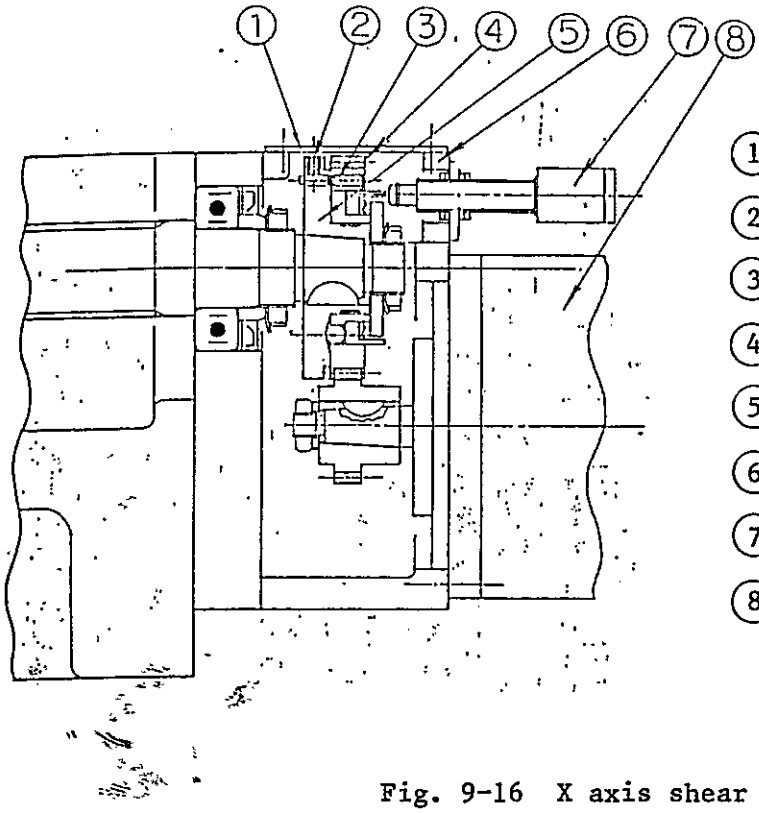
The cause can be seen at the address R103 of PCDGN.
The operation is similar to those described in 9-7-2.

ADDRESS	7	6	5	4 AL5	3 AL4	2 AL3	1 AL2	0 AL1
R103								

0	No alarm in control box
1	Some alarms in control box
0	X axis shear pin not broken.
1	X axis shear pin broken.
0	Z axis shear pin not broken.
1	Z axis shear pin broken.
0	No alarm in CNC unit.
1	Some alarms in CNC unit.
0	Hydraulic pressure normal
1	Hydraulic pressure dropped

9-8 Replacement of shear pin

9-8-1 Shear pin of X axis



①	Cover	6300538
②	Set screw	XTHF0408
③	Shear pin	6300532
④	Gear	6300531
⑤	Bushing	6300529
⑥	Cap	6300537
⑦	Limit switch	6300518
⑧	Servo motor	

Fig. 9-16 X axis shear pin

1) Remove the cover ①, the cap ⑥ attaching 2 bolts and withdraw the cap ⑥ together with the limit switch ⑦.

2) Rotate the bushing ⑤ by making use of ϕ4 mm (0.16 in.) hole at its outer surface to meet broken shear pin in the gear ④ to ϕ5.5 mm (0.22 in.) hole at the bushing ⑤ face. Then, drive out the broken shear pin from the gear ④ through ϕ5.5 mm (0.22 in.) hole.

3) After loosening the set screw ②, drive out the broken shear pin from the bushing ⑤ through ϕ5.5 mm (0.22 in.) hole of the gear ④.

4) Drive in a new shear pin and fix it by set screw ②.

8000 ÷ 0

5) Install the cap (6) and the cover (1) in the reverse order to 1).

6) Select MDI by mode select switch on operation panel.

7) Depress the key "PC/NC".

8) Depress the key "PCPRM" and then, the key "KEEPRL" and, set the cursor to KEEP RELAY No.06.

9) Depress the data key "0" and then, the key "INPUT".

No	ADDRESS	DATA
06	K05	0 0 0 0 0 0 0 0

10) Turn off the power once, and then, turn it on with the power OFF and ON buttons.

Note) The operations from 6) to 10) above is to reset the KEEP RELAY. When the shear pin is broken, "1" is set at the DATA of KEEP RELAY No.06. Therefore, to release the emergency stop condition, change the DATA of "1" by "0" and, switch off and on the power once.

9-8-2 Shear pin of Z axis

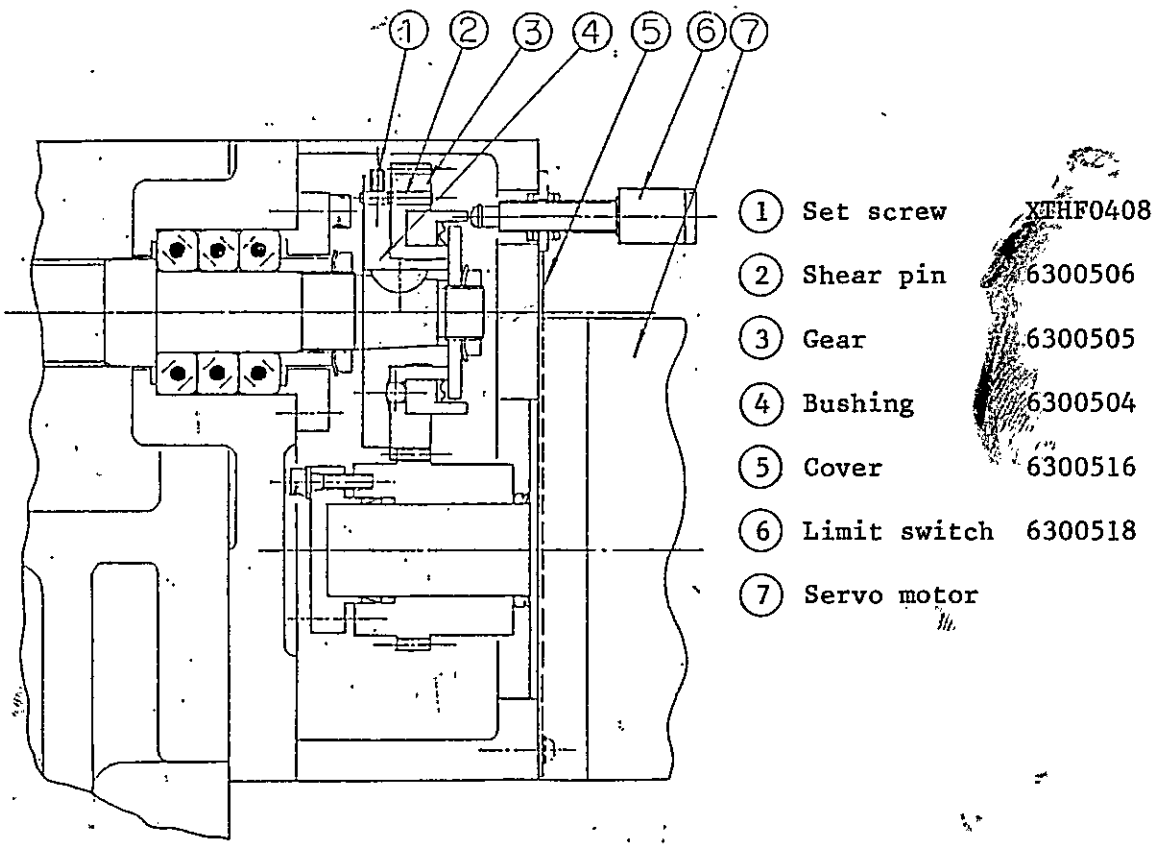


Fig. 9-17 Z axis shear pin

1) Remove the cover ⑤.

2) Rotate the bushing ④ by making use of ϕ4 mm (0.16 in.) hole at its outer surface to meet broken shear pin in the gear ③ to ϕ5.5 mm (0.22 in.) hole at the bushing ④ face. Then, drive out the broken shear pin from the gear ③ through ϕ5.5 mm (0.22 in.) hole.

3) After loosening the set screw ①, drive out the broken shear pin from the bushing ④ through ϕ5.5 mm (0.22 in.) hole of the gear ③.

4) Drive in a new shear pin and fix it by set screw ①.

5) Install the cover ⑤.

6) Release the emergency stop condition by the same operation as is described in the paragraph 9-8-1, from 6) to 10).

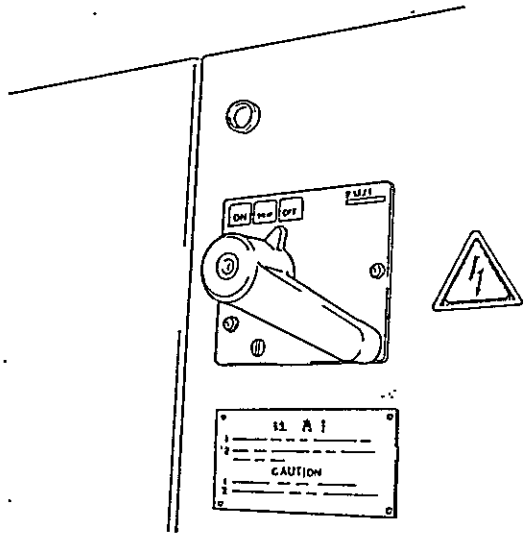
10. INSPECTION BEFORE OPERATION

Before starting the operation, carry out the following inspection.

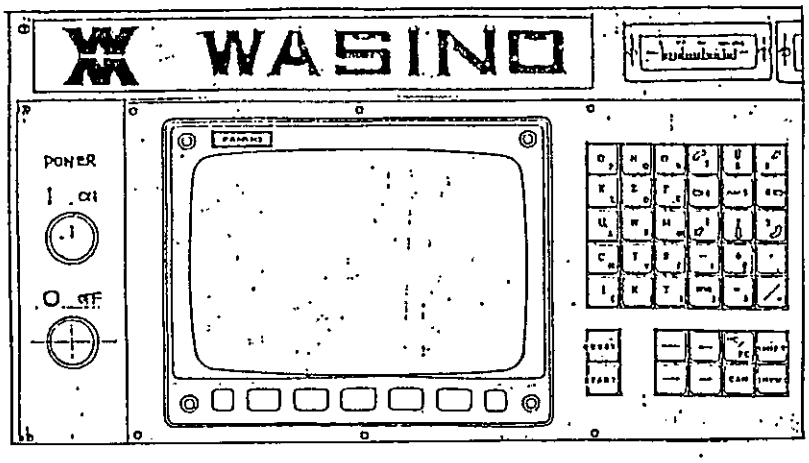
a. Check that the chuck, tool holders and tools, etc. are securely fixed. Make sure that the floor area around the machine is clear.

b. Check that a sufficient amount of oil remains in the hydraulic pump tank.

c. Turn the power source on as follows:
Turn on the no-fuse breaker for the main power.
Then, the main power indicator lamp lights on (the work light is also lit.)



d. Depress the power ON button for the CNC unit. In a few seconds, the "NOT READY" display on the CRT comes off and the "LSK" display appears at the buttom of the CRT.



e. Carry out the following daily inspection and maintenance.

Main machine	Check that a sufficient amount of oil remains in the lubrication oil tank.
	Check that the turret has a sufficient amount of oil up to the indication line.
	Check that the oil level inside the bottom of the headstock is up to the indication line.
	Check that the oil level of the oil bath for the X axis ball screw is up to the indication line.
	Check that cutting chips are not accumulated inside the chip pan.
	Make sure that there is a sufficient amount of cutting oil.

f. Carry out warm-up operation for 30 minutes.

For this, move the turret in the direction of X and Z axes slowly until the temperature gets to the normal operating temperature. Increase the feed gradually until it reaches the rapid traverse. Run the spindle at 500 rpm for a while. It is useful to make a warm-up tape.
If a warm-up operation is not carried out, the best performance of the machine may not be obtained.

Note) The CNC machine does not operate normally unless the reference point return after turning the power on.
Therefore, be sure to carry out the reference point return as the first thing after turning the power on and then make other operations.

APPENDIX I. On the 2.5°- step high precision spindle indexing (LJ-62M/102M)

1. Specifications

This spindle indexing device on LJ-62M/102M permits the high accuracy indexing of the spindle by the step of 2.5 degree.

	Specification
Repeatability	±5"
Angular error	±2"
Indexing time	3.5 sec. approx.
Releasing (Spindle lock OFF) time	0.7 sec. approx.

2. Operation

To index the spindle, command according to the following format:

M52 S0000:

→ The value of S should be a multiple of 25 (2.5°) and the range is 0 ~ 3600. It should be commanded necessarily in absolute.

Example)

To index the spindle at 30° position:

M52 S300;

To index the spindle at 135° position:

M52 S1350;

To index the spindle at 12.5° position:

M52 S125;

To release the spindle index lock, command the following:

M53;

3. Cautions

a) Only the absolute designation based on the reference point (S0) can be accepted as spindle indexing command. Incremental command cannot be made.

b) If only M52 is commanded without S code, it is regarded as M52 S0; and executed.

c) Even if the S code exceeding S3600 is commanded, it is equivalent to S0.

d) The S code must be a multiple of 25. Otherwise, the spindle cannot be locked after indexing and the alarm may occur during cutting. On the other hand, if the S codes which differ from the multiples of 25 by 0.1° such as S24, S26 are commanded, the spindle may be locked at the 2.5° position.

e) The spindle indexing by M52 S0000; can repeatedly be commanded. That is, it is not necessary to release the spindle with M53 after each indexing.

f) When commanding the spindle indexing, the milling spindle motor must be stopped.

4. Adjustment

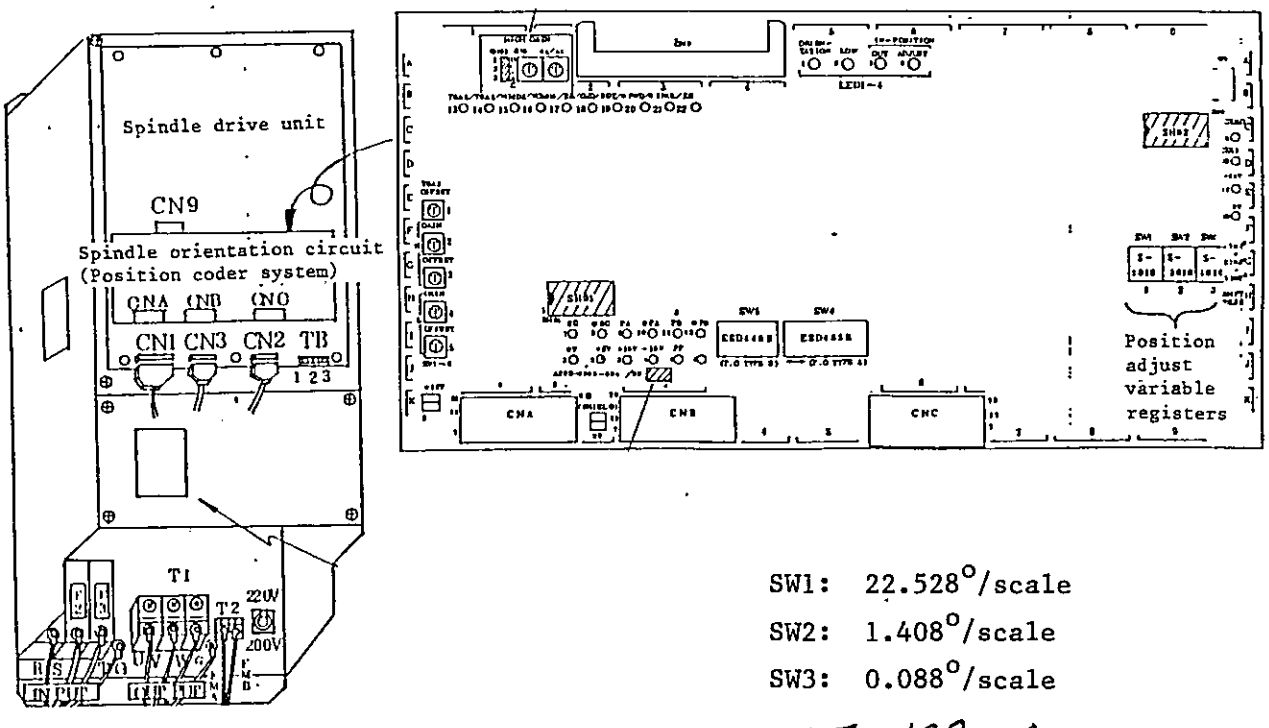
a) Change the setting of parameter No.5624 of the CNC unit from 360 to 3600.

b) Change the setting of timer 15 with PC parameter from 1000 to 496.

c) Check that the DGN X002.2 of PC is ◌ when turning on the power. If it is ø, adjust the spindle lock OFF confirming limit switch so that it becomes ◌. (Refer to h) below.)

d) Command M52 S0; by MDI

If the rack does not engage with the wheel gear smoothly, adjust the variable registers on the PCB for orientation in the spindle drive unit at the inside of control box.



SW1: 22.528°/scale
SW2: 1.408°/scale
SW3: 0.088°/scale

LJ-102 M
SW1: ③
SW2: ④
SW3: WAS Ⓐ CLOCKWISE TURN TO Ⓑ

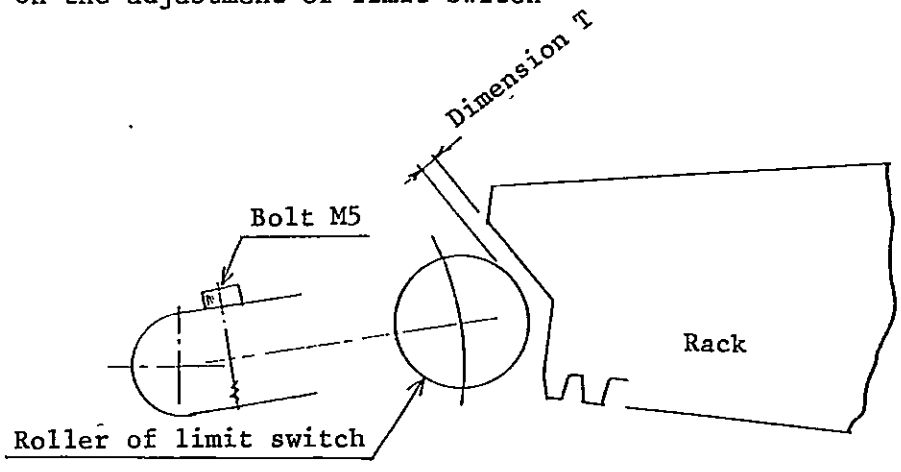
e) After resetting, command M53.

f) Repeat the adjustment d) and e) above until the rack engages with the wheel gear completely and still further smoothly.

g) Adjust the spindle lock ON confirming limit switch such that the DGN X002.2 of PC is ϕ only when the rack is completely engaging with the gear.
To the contrary, it must be ◌ when the rack runs on the gear tooth.

Note) When the rack engages with the gear completely, the rack drops by tracing an arc. At this moment, the spindle moves forward very slightly.
And, when the rack disengages with the gear, the spindle moves backward very slightly.
The adjustment of orientation should be done so that the spindle behaves as described above.
It is almost impossible to adjust it such that the spindle does not move at all. In addition, in view of indexing accuracy of spindle orientation, it may happen that the rack runs on the gear tooth.
It is noted that the adjustment should not be done such that the spindle moves very slightly in the reverse directions of the above.

h) On the adjustment of limit switch



1) Disengage the rack by commanding M53.

2) Under this condition, check that there is a clearance of 3 ± 0.5 mm between the rack and the top of gear tooth.

3) Check that the limit switch actuates by the dimension T of $5\ ^{0}_{+1}$ mm in the figure above. (When it functions, DGN X002.2 of PC becomes ϕ.)

4) After actuation of the limit switch in 3), return the roller to check that the limit switch is released (returned) by the dimension T of $3\ ^{0}_{-1}$ mm. (When it is released, DGN X002.2 becomes ◌.)

Note) The above adjustment of 3) and 4) should be done by changing the roller attaching angle after loosening the bolt M5 of limit switch.

APPENDIX II. LIST OF G FUNCTIONS

Group	G code system A	Function	2-axis machine	3-axis machine
01	G00	Positioning (Rapid traverse)	B	B
	G01	Linear interpolation (Cutting feed)	B	B
	G02	Circular interpolation CW	B	B
	G03	Circular interpolation CCW	B	B
00	G04	Dwell	B	B
	G09	Exact stop	B	B
	G10	Data setting	O	O
02	G17	Xp-Yp plane selection (Xp: X axis or its parallel axis, Yp: Y axis or its parallel axis)	B	B
	G18	Zp-Xp plane selection (Zp: Z axis or its parallel axis)	B	B
	G19	Yp-Zp plane selection	B	B
06	G20	Inch data input	O	O
	G21	Metric data input	O	O
04	G22	Stored stroke check ON	O	O
	G23	Stored stroke check OFF	O	O
00	G27	Reference point return check	B	B
	G28	Return to the first reference point	B	B
	G29	Return from reference point	B	B
	G30	Return to the n-th reference point	O	O
	G31	Skip function	O	O
01	G32	Straight and taper thread cutting	B	B
	G34	Variable lead thread cutting	O	O

Group	G code system A	Function	2-axis machine	3-axis machine
00	G37	Automatic tool compensation (Z axis)	O	O
	G37.1	Automatic tool compensation #1	O	O
	G37.2	Automatic tool compensation #2	O	O
	G37.3	Automatic tool compensation #3	O	O
07	G40	Tool nose radius compensation (cancel)	B	B
	G41	Tool nose radius compensation (left)	B	B
	G42	Tool nose radius compensation (right)	B	B
00	G50	Coordinate system setting Max. spindle speed setting	B	B
17	G50.1	Programmable mirror image reset	O	O
	G51.1	Programmable mirror image set	O	O
00	G52	Local coordinate system setting	B	B
	G53	Mechanical coordinate system setting	B	B
14	G54	Selection of work coordinate system 1	B	B
	G55	Selection of work coordinate system 2	B	B
	G56	Selection of work coordinate system 3	B	B
	G57	Selection of work coordinate system 4	B	B
	G58	Selection of work coordinate system 5	B	B
	G59	Selection of work coordinate system 6	B	B
15	G61	Exact stop mode	B	B
	G64	Cutting mode	B	B
00	G65	Calling of custom macro	O	O
13	G66	Modal calling of custom macro A	O	O
	G66.1	Modal calling of custom macro B	O	O
	G67	Modal calling of custom macro A/B (Cancel)	O	O

Group	G code system A	Function	2-axis machine	3-axis machine
11	G68	Double turret mirror image set	O	O
	◤ G69	Double turret mirror image reset	O	O
00	G70	Finishing cycle	B	B
	G71	Stock removal in turning	B	B
	G72	Stock removal in facing	B	B
	G73	Pattern repeating	B	B
	✓ G74	Peck drilling in Z axis	B	B
	G75	Grooving in X-axis	B	B
	G76	Thread cutting ycle	B	B
09	◤ G80	Drilling cycle cancel	O	B
	G81	Drilling cycle, Spot drilling cycle	O	B
	G82	Drilling cycle, Counter boring cycle	O	B
	✓ G83	Peck drilling cycle	O	B
	G83.1	Peck drilling cycle	O	B
	G84	Tapping cycle	O	B
	G84.1	Counter tapping cycle	O	B
	G85	Boring cycle	O	B
	G86	Boring cycle	O	B
	G86.1	Fine boring cycle	O	B
	G87	Pack boring cycle	O	B
	G88	Boring cycle	O	B
	G89	Boring cycle	O	B
01	G90	O.D./I.D. cutting cycle	B	B
	G92	Thread cutting cycle	B	B
	G94	Face cutting cycle	B	B

Group	G code system A	Function	2-axis machine	3-axis machine
12	G96	Constant surface speed control	B	B
	◤ G97	Constant surface speed control cancel	B	B
05	◤ G98	Feed per minute	B	B
	◤ G99	Feed per revolution	B	B

Notes) 1. In the above classification, "B" means the standard functions and "O" the options defined by WASINO. The classification is different from that of FANUC.

2. G codes with the mark ◤ are selected and effective when turning on the power. However, G00, G01, G98 and G99 depend on the parameter setting (Data No. 2401).

3. G20 and G21 are always modal and thus, not related to the power ON or OFF.

4. Refer to the Operator's manual of FANUC SYSTEM 10TA for detail.

APPENDIX III. LIST OF M FUNCTIONS

M Code	Function	LJ-62 102	LJ-62M 102M	LJ-63M 103M
00	Program stop	B	B	B
01	Optional program stop	B	B	B
02	End of program	B	B	B
03	Main spindle start (CW)	B	B	B
04	Main spindle start (CCW)	B	B	B
03	Milling spindle start (CW)		B	B
04	Milling spindle start (CCW)		B	B
05	Main spindle/Milling spindle stop	B	B	B
07	Powerful coolant on	O	O	O
08	Coolant on	B	B	B
09	Coolant, Air off	B	B	B
10	Chuck clamp	B	B	B
11	Chuck unclamp	B	B	B
19	Spindle orientation	O	B	B
20	Air on	O	O	O
30	End of tape	B	B	B
32	Tailstock quill advance	B	B	B
33	Tailstock quill retract	B	B	B
34	Unloader (Parts catcher) advance	O	O	O
35	Unloader (Parts catcher) retract	O	O	O
40	Low speed gear	B	B	B
41	High speed gear	B	B	B
46	Automatic door open	O	O	O
47	Automatic door close	O	O	O
48	Chamfering effective	B	B	B
49	Chamfering ineffective	B	B	B
52	Spindle (C-axis) lock		B	B
53	Spindle (C-axis) unlock		B	B

M Code	Function	LJ-62/102	LJ-62M/102M	LJ-63M/103M
54	C-axis gear on			B
55	C-axis gear off			B
82	Tailstock body advance	O	O	O
83	Tailstock body retract	O	O	O
98	Calling of subprogram	B	B	B
99	End of subprogram	B	B	B

Notes) 1. B: Standard, O: Option

2. Refer to the Programming manual for detail.

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